96-04227

BEFORE THE
FLORIDA PUBLIC SERVICE COMMISSION

In the Matter of :	DOCKET NO.
Application for a rate increase and increase in service availability charges by SOUTHERN STATES UTILITIES, INC. for Orange-Osceola Utilities, Inc. in Osceola County, and in Bradford, Brevard, Charlotte, Citrus, Clay, Collier, Duval, Highlands, Lake, Lee, Marion, Martin, Nassau, Orange, Osceola, Pasco, Putnam, Seminole, St. Johns, St. Lucie, Volusia and Washington Counties. :	**950495-WS**

FOURTH DAY - MORNING SESSION

VOLUME 15

Pages 1527 through 1689

PROCEEDINGS: **HEARING**

BEFORE: CHAIRMAN SUSAN F. CLARK
COMMISSIONER J. TERRY DEASON
COMMISSIONER JULIA L. JOHNSON
COMMISSIONER DIANE K. KIESLING
COMMISSIONER JOE GARCIA

DATE: **Friday, May 3, 1996**

TIME: Commenced at 9:00 a.m.

PLACE: Betty Easley Conference Center
Room 148
4075 Esplanade Way
Tallahassee, Florida

REPORTED BY: JOY KELLY, CSR, RPR
Chief, Bureau of Reporting
(904) 413-6732

APPEARANCES:

(As heretofore noted.)

And

DAROL CARR, Far, Far, Everett, Syfrett and Carr, 2315 Aaron Street, Port Charlotte, Florida 32952, Telephone No. (941)-625-6171, on behalf of **Burnt Store.**

JOSEPH McGLOTHLIN, McWhirter, Reeves, McGlothlin, Davidson & Bakas, 315 South Calhoun Street, Suite 716, Tallahassee, Florida 32301, Telephone No. (904)-222-2525, on behalf of **Keystone Heights and Marion Oaks.**

WITNESSES

EXHIBITS

P R O C E E D I N G S

(Hearing reconvened at 9:00 a.m.)

(Transcript follows in sequence from Volume 14.)

CHAIRMAN CLARK: We'll reconvene the hearing. As I indicated last night, we will take Dr. Beecher first, and she is a Staff witness. Ms. Capeless, is she your witness?

MS. CAPELESS: Yes, she is.

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JANICE A. BEECHER

was called as a witness on behalf of the Staff of the Florida Public Service Commission and, having been duly sworn, testified as follows:

DIRECT EXAMINATION

BY MS. CAPELESS:

Q Dr. Beecher, would you please state your name and business address for the record?

A Janice A. Beecher. My business address is the Center for Urban Policy and the Environment, Indiana University, 342 North Senate Avenue, Indianapolis, Indiana 46204.

Q And are you the same Janice A. Beecher who prefiled or caused to be prefiled direct testimony in this docket consisting of 35 pages?

A Yes, I am.

Q Do you have any changes or corrections to make to your testimony?

A No, I do not.

Q If I were to ask you the same questions as posed in your testimony, would your answers be the same today?

A Yes, they would.

MS. CAPELESS: Madam Chairman, may we please have Dr. Beecher's testimony inserted into the record as though read?

CHAIRMAN CLARK: The prefiled direct testimony of Dr. Janice A. Beecher will be inserted into the record as though read.

MS. CAPELESS: Thank you.

Q (By Ms. Capeless) Dr. Beecher, did you also prefile Exhibit JAB-1 through JAB-9 along with your testimony?

A Yes, I did.

Q Do you have any corrections or changes to make to those exhibits?

A No, I do not.

MS. CAPELESS: May we have those identified as Exhibit 133, please?

CHAIRMAN CLARK: You are ahead of me. I

have 132. Am I in error?

MS. CAPELESS: Do you want the testimony and the exhibits to be the same exhibit number?

CHAIRMAN CLARK: No. The testimony would not be an exhibit. It's simply inserted into the record.

MS. CAPELESS: Okay. Thank you. 132.

CHAIRMAN CLARK: JAB-1 through 9 will be marked as Exhibit 132.

(Exhibit No. 132 marked for identification.)

DIRECT TESTIMONY OF JANICE A. BEECHER

Q. Would you please state your name and business address?

A. Janice A. Beecher, Ph.D., Center for Urban Policy and the Environment, School of Public and Environmental Affairs, Indiana University Purdue University at Indianapolis, 342 N. Senate Avenue, Indianapolis, Indiana 46204.

Q. By whom are you employed and in what capacity?

A. I have been employed since April 1, 1995 as a Senior Research Scientist and Director of Regulatory Studies at the Center for Urban Policy and the Environment, School of Public and Environmental Affairs, Indiana University Purdue University Indianapolis. The Center is a nonprofit research and assistance organization. I also am an Adjunct Professor in the School of Public and Environmental Affairs, Indiana University Purdue University Indianapolis, where I teach on a part-time basis.

Q. Please state your educational background and give a summary of your professional experience.

A. I received my B.A. in economics, political science, and history from Elmhurst College, Illinois, in 1979. I received my M.A. in Political Science from Northwestern University in 1980. I received my Ph.D. in Political Science from Northwestern University in 1986. I majored in Public Policy with minors in Political Behavior & Institutions, Law & Politics, and Urban Politics. My doctoral thesis was entitled *Uncertain by Design: A Structural Theory of Regulation by the State Public Utility Commissions.*

From November 1, 1988 to March 31, 1995, I managed the water research program of the National Regulatory Research Institute (NRRI) at The Ohio State

University. NRRI is the research arm of the National Association of Regulatory Utility Commissioners (NARUC). While at NRRI I was the project manager and senior author for several research projects on water utility regulation and related issues. These projects resulted in numerous monographs, articles, papers, and presentations. From November 1, 1983 to October 31, 1988, I worked for the Chairman of the Illinois Commerce Commission as a policy analyst and advisor. The Illinois Commerce Commission regulates public utilities in Illinois.

I have a general background in economic regulatory policy and decisionmaking and I specialize in the structure and regulation of the water utility industry.

Q. What are some of your publications?

My NRRI publications include *Regulatory Implications of Water and Wastewater Utility Privatization* (1995), *Revenue Effects of Water Conservation and Conservation Pricing* (1994), *Meeting Water Utility Revenue Requirements* (1993), *Viability Policies and Assessment Methods for Small Water Utilities* (1992), *Integrated Resource Planning for Water Utilities* (1991), *Compendium on Water Supply, Drought, and Conservation* (1989), and *Cost Allocation and Rate Design for Water Utilities* (1990, also published by the American Water Works Association Research Foundation).

In addition I have authored two articles and coauthored one article appearing in the *Journal of the American Water Works Association*. I also have coauthored a book entitled *Forecasts and Environmental Decisionmaking* and several ancillary publications for college level American Government textbooks.

Q. In what other professional activities are you engaged?

I am actively involved as a member of the American Water Works Association (AWWA). I serve on the Rates and Charges Subcommittee of the Financial Management Committee. I also serve on the Conservation Committee and as a liaison from the Conservation Committee to the AWWA Management Division. I presently serve on a project advisory committee for the American Water Works Association Research Foundation and have served as a technical reviewer for the *Journal of the American Water Works Association.*

I serve as an Instructor for the water utility seminars included in the regulatory training programs organized on behalf of the National Association of Regulatory Utility Commissioners by the Institute of Public Utilities, Michigan State University.

I continue to work in a research and advisory capacity with staff members involved in water utility regulation at the various state public utility commissions, with professional colleagues in the public and private sectors, and with faculty colleagues and students.

Q. Have you attached a current resume?

A. Yes, I have attached my resume to my testimony as Exhibit No. JAB-1.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to provide the Florida Public Service Commission with general background information about the structure and regulation of the water utility industry in the United States. I will present late-1995 data on the number of regulated utilities in each state and the nature of state commission jurisdiction. I also will discuss issues and trends affecting the water utility industry. My testimony is based largely on my own previously published research findings, as noted.

In addition, my testimony will present the findings of a recent survey of state commission staff on the issue of single-tariff pricing. I conducted the survey in preparation for this testimony. My goal was to compile current and detailed information on the use of single-tariff pricing by the state public utility commissions. I will present some of the arguments in favor and against the use of single-tariff pricing as a matter of commission policy, as well as commission staff perceptions about which arguments entered into the decisionmaking processes as the issue was addressed in their states.

Q. How many community water systems operate in the United States?

A. I will use information from my recently completed report, the *1995 Inventory of Commission-Regulated Water and Wastewater Utilities* (Indianapolis, IN: Center for Urban Policy and the Environment, 1995), to answer this question.

While the water industry may appear small through the lens of the state public utility commissions, it actually is a very large, complex, and diverse industry. The U.S. Environmental Protection Agency, and the state primacy agencies, count noncommunity and community water systems and record these data in the *Federal Reporting Data System (FRDS)*. *FRDS* data as of January 23, 1995, identified a total of 55,356 community water systems in the United States. A community water system is a system serving a population of 25 or more people, with at least 15 service connections.

The data confirm both the large numbers of water systems in the United States, as well as the large proportion of smaller systems. Relatively small systems, defined as systems serving communities with a population under 3,300 persons, comprise about 87 percent of total systems and provide water to approximately 13 percent of the population served by community systems. Conversely, about 13 percent of community water systems are larger in size and provide water to approximately 87 percent of the population served.

Q. How are water systems regulated by the states?

A. Regulation of the water industry, like the water industry itself, is fragmented and pluralistic. All community water systems, regardless of their ownership, are subject to federal and state drinking water regulations pursuant to the federal Safe Drinking Water Act. These standards focus on public health concerns. Water systems in many states also are subject to water quantity regulations, meaning that water withdrawals are regulated through registration or permitting mechanisms. Economic regulation of water utility prices and rates of return is the domain of the state public utility commissions. The commissions play a quasi-administrative, quasi-legislative, quasi-judicial role in making and implementing public policy for the regulated utility industries.

Forty-five commissions presently have authority to regulate investor-owned water utilities. In some of the states, commission regulation also extends to other types of water utilities under certain circumstances. For example, some states regulate municipal water utilities if they provide service outside of municipal boundaries. Many variations among the states in terms of commission jurisdiction and authority can be found.

Not all water utilities are subject to commission regulation. The majority of water utilities in the United States are publicly owned and not subject to state economic regulation. The state public utility commissions do not regulate water utilities in Georgia, Minnesota, North Dakota, South Dakota, or Washington, D. C. In late 1995, according to a commission source, the state of Michigan ceased to regulate water utilities.

Q. How many water and wastewater utilities are regulated by the state public utility commissions in the United States?

A. Exhibit No. JAB-2 provides a summary of the inventory of commission-regulated water and wastewater utilities in 1995. As shown in that exhibit, the total number of commission-regulated water utilities in the United States is approximately 8,537. Approximately 4,095 regulated water utilities are classified as investor-owned water utilities. These data include 15 investor-owned utilities and 3 homeowners' associations that no longer are regulated in Michigan.

Leading states in terms of the number of regulated water utilities are Texas (3,300), Mississippi (740), Wisconsin (573), West Virginia (421), Arizona (354), and New York (354). For investor-owned water utilities, leading state jurisdictions are Texas (1,200), Arizona (354), New York (334), North Carolina (226), Florida (210), California (199), and Pennsylvania (190).

Q. How has the number of regulated water utilities changed?

A. Since 1989, I have conducted periodic surveys to count the number of regulated water and wastewater systems. Between the 1989 and 1995 surveys, the number of regulated investor-owned utilities declined by 445 utilities (11 percent); the total number of regulated utilities declined by 1,398 utilities (16 percent).

States in which the number of regulated water utilities (including investor-owned utilities) declined by a substantial amount include Arizona, Connecticut, Indiana, New York, North Carolina, Pennsylvania, and Texas. Anecdotal evidence suggests that mergers and acquisitions were the leading cause of the decline. Systems rarely cease operations altogether. However, transfers to unregulated ownership forms and changes in commission jurisdiction also can contribute to the decline in the number of regulated utilities. A few states, including Mississippi and Oregon, had substantial increases in the number of utilities under their jurisdiction. Nebraska's gain is noteworthy because jurisdiction was initiated in 1994.

Q. Does the overall decline in the number of regulated water utilities indicate a decline in the presence of the regulated water industry?

A. No. The decline in the number of regulated utilities is consistent with an anticipated trend in industry consolidation. Mergers and acquisitions within both the public and private segments of the industry will gradually reduce the number of regulated utilities. However, the population served by regulated utilities will not necessarily decline as a result of consolidation activity.

Despite the decline in the number of regulated water utilities, water utility regulation continues to rise in importance on the agendas of many state commissions. Economic regulation of water utilities is important given monopoly power, rising costs, structural change, and a degree of uncertainty about the water supply industry.

Q. What types of public policies support consolidation or regionalization of the water-supply industry?

A. Modern public policies, including regulatory policies, appear to support consolidation of the water-supply industry to achieve economies of scale. The emphasis on water system viability at the federal, state and local levels will make it harder for providers to get operating certificates, water-supply permits, and special financing. Explicitly or implicitly, growth management policies in some states are calling for consolidation of water supply through interconnection with existing systems. Public policy also appears to emphasize the importance of establishing and maintaining water systems for which the population served can support the cost of water service. Thus, institutional factors also are playing a role in reducing the number of water systems.

Q. How does the number of regulated water utilities compare to the number of regulated water systems?

A. The state public utility commissions typically count the number of regulated water *utilities* but not necessarily water *systems*. The distinction between utilities and systems can be important in that some utilities encompass multiple community water systems. The presence of multi-system utilities is an important feature of economic regulation in many states.

In some states, regulated utilities and systems may be identical in most or all cases. However, staff members in several states attempted to provide estimates of the number of water systems represented by the regulated utilities. According to the *1995 Inventory*, the number of commission-regulated water *utilities* is about 8,537 and the number of commission-regulated water *systems* is about 11,064.

Compared to the total number of community water systems (55,356), commission-regulated systems comprise about 20 percent. This finding generally is consistent with other estimates, although the number and percentage of commission-regulated systems probably is somewhat underestimated because of the difficulty in counting systems as compared with utilities.

Q. How many water systems are in the State of Florida?

A. According to the U.S.EPA's FRDS Data (January 23, 1995), Florida has approximately 3,772 transient noncommunity water systems, 1,184 nontransient noncommunity water systems, and 2,153 community water systems, for a total of 7,109 water systems. Of Florida's 2,153 community water systems, 1,793 serve populations under 3,300. Florida ranks ninth in the number of total water systems; seventh in the number of community water systems; and seventh in the number of smaller water systems (serving populations under 3,300). Florida's large number of water systems and large number of small water systems are significant in public policy terms.

Q. What agencies regulate water utilities in Florida?

A. In Florida, federal and state drinking water quality regulations are administered by the Department of Environmental Protection (DEP). DEP has delegated responsibility to some county health departments. Florida's five regional Water Management Districts (WMDs) are responsible for water quantity regulation. The jurisdiction of the WMDs is based on hydrogeologic, rather than political, boundaries.

The Florida Public Service Commission (PSC) has jurisdiction for the rates and charges, service, and service territory of the investor-owned water and wastewater utilities in counties in which it has jurisdiction. Florida exempts from regulation systems with the capacity to serve under 100 people, resale water, landlords, cooperatives, and homeowners' associations (except under certain circumstances). Since 1959, county governments in Florida have had the option to regulate water and wastewater utilities or transfer that responsibility to the PSC. Currently, thirty-nine Florida counties have transferred economic regulatory responsibility to the Florida PSC.

Q. In general, what is the cost profile of water supply?

A. Water utilities remain one of the more tried and true monopolies in terms of basic economic characteristics. In general, water service can be provided efficiently by a vertically integrated supplier; two or more suppliers (or redundant distribution systems) in the same service area would greatly increase costs and rates. The technology of water supply clearly demonstrates economies of scale, meaning that unit average costs decrease with the quantity of water provided. The prevalence of many small utilities undermines the industries' overall efficiency in terms of achieving economies of scale.

Even in comparison to other utilities, water utilities require substantial investment in fixed assets relative to the variable costs of production (including the cost of raw water, energy, and treatment chemicals). Using the standard of capital investment per revenue dollar, water supply is among the most capital-intensive of all utility sectors. Capital investment in water supply mainly is a function of the need to establish production capacity; maintain a complex storage, transmission, and distribution network; and meet both fire-protection specifications and peak demands. In general, the water supply industry has high fixed costs and low capital-turnover rates. However, the capital intensity of the water supply industry also can be explained by the industry's relatively low variable (operating) costs, which translate into relatively low operating revenues.

Reflecting these cost characteristics, water rates typically take the form of a fixed charge that does not vary with usage and a variable charge that does vary with usage. Traditional cost-of-service principles can lead to very high fixed charges and very low variable charges for water utilities. Conservation-oriented rates, however, emphasize the importance of variable charges in affecting consumption behavior.

Q. How is the cost profile of the water industry changing?

A. Water supply is a rising-cost industry. Water supply utilities, and their regulators at the federal, state, and local levels, are increasingly aware of the water supply industry's changing revenue requirements. Three key forces affecting the industry's costs are: 1) the need to comply with regulatory provisions of the Safe Drinking Water Act (SDWA); 2) the need to replace and upgrade an aging water delivery infrastructure; and 3) the need to meet population growth and economic development. In addition, water utilities face a variety of secondary cost forces. These include the sometimes high cost of borrowing to finance capital projects (especially for small systems) and the shift to nonsubsidized, self-sustaining operations (especially for publicly owned systems).

The concurrent and mutually reinforcing impact of these forces on many utilities presents a substantial pressure on both capital and operating costs, a pressure not previously experienced by the water supply industry. In response, water utilities are reexamining their cost allocation and rate design practices. The interest in alternative ratemaking methods for the water sector is on the rise.

Q. How should utility regulators respond to the change in the water utility cost profile?

A. Rising costs, along with structural and regulatory changes in this industry, are placing new demands on utility regulators. However, rising costs should not be taken for granted but closely scrutinized. Moreover, the water supply industry must be held accountable for making prudent decisions in response to its changing cost profile. The industry must be able to fully justify the use of alternative approaches to meeting revenue requirements (including automatic adjustment mechanisms and pass-throughs, as well as cost allocation and rate design methods).

Water utility regulators should be open to the consideration of alternatives but vigilant about how these methods are applied. Regulators will want to be especially cautious about affecting the incentives that determine whether utility costs are effectively managed. Thus, the industry perspective on rising costs and how to address them should be tempered by a reasoned regulatory perspective.

Q. In the context of rising prices, is water service affordability a concern?

A. For many water customers, the affordability of water service is a growing problem. The problem of affordability affects customers in terms of increased arrearages, late payments, disconnection notices, and actual service terminations. Affordability affects utilities in terms of expenses associated with credit, collection, and disconnection activities; revenue stability and working capital needs; and bad debt or uncollectible accounts the other customers must cover.

Other ramifications of the affordability issue also are becoming apparent. If a customer base cannot support the cost of water service, potential lenders may be concerned about the utility's financial viability and ability to meet debt obligations. Moreover, disconnecting residential water customers can present a public relations nightmare for utilities, particularly because essential services are involved. Increasingly, problems of bad debt also extend to nonresidential utility customers. Financial distress and bankruptcies in the commercial and industrial sectors can leave utilities holding the bag. However, the larger issue of affordability is primarily a concern with respect to low-income residential consumers.

For low-income customers, who have little choice but to buy service from the local utility, paying more for basic water service means going without less essential and more discretionary products and services. Thus, rising water prices can contribute to a deterioration in the quality of life for low-income utility customers.

Q. Why are small water systems a particular concern to regulators?

A. Small water systems have long troubled utility regulators. Many (but certainly not all) of the commission-regulated water systems are small in size, which poses certain public policy problems. Particularly problematic are the very small systems that were the product of unchecked real estate development and lax local zoning policies. Many of these systems are geographically isolated, which often precludes interconnection with another system. Traditionally, both economic and public health regulators have been very focused on small system viability issues.

As a utility monopoly, water supply demonstrates substantial economies of scale. Larger water systems enjoy these economies, meaning that they can spread certain costs over a larger customer base. Lower production costs are reflected in lower prices to customers. Smaller systems must recover revenue requirements over a smaller customer base. In general, smaller systems are more likely to encounter viability problems.

Q. What is meant by viability problems?

A. As discussed in my report *Viability Policies and Assessment Methods for Small Water Utilities* (Columbus, OH: The National Regulatory Research Institute, 1992), viability can be defined in terms of financial, managerial, and technical viability. Financial viability carries particular importance because a financially healthy utility will have the resources needed for professional management and technically appropriate operations. Many (but not all) small water systems have severe viability problems. These problems are manifested by the small water utility's poor performance in many areas, including regulatory compliance.

State drinking water program agencies recognize these problems in the form of violations of standards. For small systems, these violations often include failure to meet monitoring and reporting requirements. Small systems also have difficulty complying with public utility commission regulations. For very small systems, meeting the procedural requirements of economic regulation (such as those required for rate filings) can be difficult.

Q. How have the state public utility commissions addressed the problem of small system viability?

A. The commissions, which are well aware of the precarious condition of many small water systems, can and have addressed the viability issue through three basic strategies. The first strategy involves slowing the creation of new water systems. State regulations can create substantial barriers to entry for new water systems. Many of the state commissions, as well as the state drinking water agencies, are tightening the certification process and more carefully scrutinizing the financial, managerial, and technical capability of proposed new systems.

The second strategy involves procedural simplification for small water systems to lower the administrative cost of regulation and enhance regulatory compliance. This strategy includes simplifying filing and reporting procedures. In some cases, commission staff directly assist managers of small water utilities in meeting procedural requirements. Some of the commissions have used alternative regulatory methods, such as operating ratios, to further simplify the process and address the unique needs of small systems. Regulatory simplification treats one of the primary symptoms of small system viability problems (that is, regulatory compliance), but it does not necessarily treat the underlying viability problem (that is, lacking economies of scale).

The third strategy involves structural change in the water supply industry. As noted in the *Viability* report, the least-cost solution to regulatory compliance and other problems for many systems can be found only through structural change, namely consolidation. The downward trend in the number of water systems suggests that consolidation of ownership in the industry may be occurring. Consolidated systems may or may not be physically interconnected. While physical interconnection yields significant economies of scale, common management of noninterconnected systems addresses financial, managerial, and technical viability issues and can yield some economies.

Many of the commissions have played an active role in this area by encouraging and approving mergers and acquisitions. Some of the commissions will provide specific incentives, such as acquisition adjustments. Certain ratemaking practices, including single-tariff pricing, also can provide incentives for acquisitions and, perhaps, the formation of regional water systems. Larger systems interested in acquiring smaller systems tend to favor single-tariff pricing.

Q. Have you addressed the issue of single-tariff pricing in previous research reports?

A. I have not written a research report exclusively on the topic of single-tariff pricing. However, my coauthors and I mentioned this pricing approach in two previous research reports.

In *Meeting Water Utility Revenue Requirements: Financing and Ratemaking Alternatives* (Columbus, OH: The National Regulatory Research Institute, 1993), with Patrick C. Mann, we suggested that "zonal" pricing was among the pricing options for coping with rising revenue requirements. Zonal, or spatially differentiated pricing in some respects is the conceptual "opposite" of single-tariff pricing. With zonal pricing, rates are differentiated for different service areas according to substantial differences in the cost-of-service. Some utilities set prices for different zones or districts. In that report, we wrote:

> Zonal pricing recognizes that the location of consumers within the service area of the water utility, particularly relative to source-of-supply and treatment facilities, can affect the cost of

providing water service to these consumers....

[The] key issue in implementing zonal rates is one of cost justification. If substantial cost differences exist within the service area, then zonal rates may be an appropriate form of rate unbundling that attains more efficient water rates (that is, an unbundling that would occur in a competitive market). In contrast, zonal rates that are arbitrary (for example, those that are political in nature) introduce inefficiencies. Moreover, virtually all utility rate design is based on some form of averaging; zonal pricing may constitute an undesirable form of price discrimination.

Economic and engineering arguments against zonal pricing also can be made. Capital-intensive utility systems are supposed to be designed for optimal performance of all utility functions (supply, treatment, distribution, and so on) within a service territory. Spatial differentiation within the service territory may subvert this general optimum. Another potential disadvantage of zonal pricing is that it can accentuate the problem of localized cost and rate shock associated with infrastructure replacements. By broadening the customer base, a uniform or average rate would cushion the shock and temper its adverse effects (such as revenue instability). Other problems associated with implementing zonal rates include substantial administrative and implementation costs, as well as resistance from the consumers asked to pay higher water rates. The expense of developing zonal cost data probably has limited the application of zonal pricing. Thus, the major prerequisite to efficient zonal pricing is the capability to accurately calculate the cost differences associated with providing service to different zones within a utility's service territory.

More recently, the issue of single-tariff pricing was mentioned in *Regulatory Implications of Water and Wastewater Utility Privatization* (Columbus, OH: The National Regulatory Research Institute, 1995), with G. Richard Dreese and John D. Stanford. In that report, we wrote:

> Traditional methods of costing and ratemaking in a regulatory context can present a barrier to privatization activity....
>
> For some regional utilities, [a] preferred approach is single-tariff pricing (that is, a pricing structure that provides for cost averaging for combined systems rather than spatially determined rates). Averaging mitigates against rate shock for customers and revenue instability for utilities, and

> is relatively simple to administer. Single-tariff pricing can encourage economic industry consolidation and regionalization through privatization (p. 141).

Q. How do you define single-tariff pricing?

A. I have used the following definition of single-tariff pricing:

> Single-tariff pricing is used to implement a single rate structure for multiple water (or other) utility systems that are owned and operated by a single utility. With single-tariff pricing, all customers of the utility pay the same rate for service, even though the individual systems providing service may vary in terms of the number of customers served, operating characteristics, and stand-alone costs.

The terms "single-rate structure," "uniform rates," and "rate equalization" sometimes are used in connection with the concept of single-tariff pricing.

Single-tariff pricing can be applied across all of the systems comprising the water utility. However, utilities also sometimes establish rates for regional zones consisting of subsets of water systems within the larger service territory. Rate consolidation sometimes is used for contiguous water systems that are not interconnected, as well as for noncontiguous water systems that are not interconnected. These instances of partial rate consolidation can be a compromise between individualized tariffs and complete single-tariff pricing, or part of a phase-in plan leading ultimately to a single tariff.

Q. Can you provide an example of single-tariff pricing?

A. One of the best examples of a single tariff across an expansive "service territory" is the single rate used for first-class postage. Other examples can be found in the other utility sectors. For example, long-distance, cellular-phone, and cable television services typically are priced according to the single-tariff concept (although the terminology may be different). In the energy utilities, pricing usually is determined for a regional enfranchised service territory, regardless of the physical proximity of customers to specific utility facilities. The other utility sectors generally price across larger regional territories than water utilities, although facilities in the other sectors tend to be physically interconnected through transmission and distribution networks.

Q. What are the key advantages and disadvantages of single-tariff pricing?

A. The primary advantages of single-tariff pricing are that it can lower administrative and regulatory costs, improve rate and revenue stability, and ensure affordability for customers of very small (or extremely small) water systems. Importantly, single-tariff pricing is a pricing strategy, not a costing strategy. By itself, single-tariff pricing may not provide significant economies of scale because only the costs associated with the pricing process itself (including analytical, administrative, and regulatory costs) can be considered. Economies of scale in production (which requires physical interconnection) are achieved separately, regardless of the rate structure that is used.

However, single-tariff pricing can lead to economies of scale in the water industry through secondary benefits. The secondary advantages are that single-tariff pricing can encourage industry consolidation. If regionalization eventually includes physical interconnection among some or all systems managed by a utility, more significant economies of scale can be realized. Other secondary advantages include regulatory compliance and universal service.

The primary disadvantages of single-tariff pricing are that it undermines economic efficiency, distorts price signals to customers, and may not be consistent with traditional cost-of-service principles. These arguments are fundamental to utility economics, pricing, and regulation. Secondary disadvantages are that single-tariff pricing can provide utilities with incentives to overinvest, disincentives for controlling costs, and a competitive advantage in terms of acquisitions.

Q. Why is single-tariff pricing a public policy issue?

A. Single-tariff pricing is a public policy issue because it involves tradeoffs among competing policy objectives. Traditional cost-of-service principles and economic efficiency arguments, adhered to in the U.S. model of water utility regulation, can lead to the conclusion that stand-alone costs should be used as the basis for pricing utility services. Single-tariff pricing as a matter of public policy in this context requires an explicit recognition of the tradeoffs involved.

Specifically, single-tariff pricing involves a tradeoff between economic efficiency and other legitimate ratemaking goals. These other goals include, for example, small-system viability, rate and revenue stability, universal service, and compliance with environmental standards. In other words, improving economic efficiency can result in less rate stability, and vice versa. The issue of whether physical interconnection should be required for single-tariff pricing is an ongoing matter of debate. Evaluating these trade-offs can be complex. The decisionmaking process can be greatly enhanced by information and analysis, and decisions can be made more rational, but a certain degree of judgment ultimately is required in determining what is in the public interest.

Q. Did you conduct a survey of state commission staff members on the issue of single-tariff pricing?

A. Yes. In preparation for this testimony, I surveyed staff members at all of the state public utility commissions with jurisdiction for water utilities (that is, forty-five state commissions). The survey was first sent by telefax in January 1996 and followup telephone calls were made in late January and early February to ensure the completeness and accuracy of the survey. The survey was sent to staff members who responded to past surveys I have conducted. To the best of my knowledge, the survey was completed by the individuals at the commissions who are knowledgeable about water utility regulation and competent to complete this particular questionnaire. A copy of the survey questionnaire is attached as Exhibit No. JAB-3.

Q. Is single-tariff pricing for water utilities an issue for every state public utility commission?

A. No. Jurisdiction for water utilities and the presence of multi-system utilities are necessary but not sufficient conditions for single-tariff pricing to be an issue for a given commission. Single-tariff pricing does not become an issue until a utility or the commission initiates the use of this method. Utilities with systems that are viable on a stand-alone basis, by virtue of size and other factors, may not need or want single-tariff pricing. Even when considered or implemented, single-tariff pricing may not be considered "an issue."

Staff at the West Virginia commission involved in regulating public service districts noted that single-tariff pricing has been a "hot topic" because of the state's rural areas. They also note the use of both single tariffs and multiple tariffs in the state.

Exhibit No. JAB-4 provides a summary of state commission policies on single-tariff pricing for water utilities. The consideration of single-tariff pricing policy can benefit from the following perspective:

All state public utility commissions:		51
Commissions without jurisdiction for water utilities:	-	6
Subtotal		45
Commissions without multi-system water utilities:	-	16
Subtotal		29
Commissions for which single-tariff pricing has never been considered:	-	5
TOTAL		24

Based on this perspective, it is reasonable to evaluate commission policies with regard to single-tariff pricing in the context of the twenty-four commissions where multi-system water utilities operate and where the issue has been considered (including the states where single-tariff pricing has been rejected or considered but not approved). Given this context, a clear majority of affected state commissions have allowed for the use of single-tariff pricing (16 state commissions).

Of the remainder, three commissions (California, Massachusetts and New Hampshire) have allowed partial rate consolidation, one has considered but not approved single-tariff pricing (New Jersey); and two have rejected proposals for single-tariff pricing (Indiana and Vermont). For two commissions (Maryland and Mississippi), single-tariff pricing had not been an issue but staff characterized commission policy as "case-by-case". It also is noteworthy that in one of the states approving a single-tariff pricing structure (Idaho), the matter was "not a issue when proposed".

Q. What did you find in your survey of state commission staff members?

A. The results of my survey are reported in my Exhibits Nos. JAB-4 through JAB-9. The data are reasonably compete for all fifty-one public utility commissions (including the District of Columbia commission). Detailed data on specific utilities are incomplete from a few states because of the difficulty in compiling these data.

As shown in the summary data on page 7 of Exhibit No. JAB-5, six public utility commissions do not have jurisdiction for water utilities ("NJ"). In sixteen (16) of the states with jurisdiction for water utilities, staff observed that no multi-system water utilities were in operation. This finding also was established in the *1995 Inventory Report*, which was used to supplement this survey. For the remainder of the survey, responses for these sixteen states were recorded as "NA," or "not applicable."

Twenty-nine (29) state commissions regulate multi-system water utilities where single-tariff pricing is a potential issue. Of the twenty-nine (29) commissions with multi-system water utilities, sixteen (16) have approved single-tariff pricing for one or more utilities; thirteen (13) had not approved single-tariff pricing. Of the thirteen (13) commissions that had not approved single-tariff pricing, three explanations were provided: 1) single-tariff pricing had not been an issue (7 commissions); 2) a proposal for single-tariff pricing was rejected (2 commissions); and 3) single-tariff pricing had been considered but not specifically approved (4 commission). In three of the four states where single-tariff pricing had been considered but not approved, partial rate consolidation had been approved; in the fourth, a case involving single-tariff pricing was pending.

The Indiana commission reportedly rejected single-tariff pricing because of cost-of-service issues; the Vermont commission reportedly rejected single-tariff pricing because of concerns about cross-subsidies. No commission staff member reported that single-tariff pricing had been expressly prohibited. However, the Florida survey response indicated that there is proposed legislation that would limit the use of single-tariff pricing to interconnected systems.

Q. What specific data on single-tariff pricing were revealed by the survey?

A. As shown on page 13 of Exhibit No. JAB-6, data were provided for 213 multi-system utilities, of which 128 had implemented single-tariff pricing and 20 had implemented partial rate consolidation (that is, single-tariff pricing for all but a few systems or single-tariff pricing for groups of systems within the utility but not for the utility as a whole. Partial rate consolidation in some cases is used to phase-in the single tariff. The survey does not include the multi-system utilities in Texas (estimated to be 200 to 300 utilities) or all of the multi-system utilities in Florida (estimated to be 60 to 70 utilities) because these data were not readily available. Other states also may have some additional multi-system utilities for which data were not reported. The survey also excludes publicly owned water utilities, with the exception of West Virginia for which data were available for commission-regulated public service districts. The reported 148 water utilities using single-tariff pricing or partial rate consolidation are comprised of approximately 1,872 systems. The reported 55 water utilities not using single-tariff pricing are comprised of approximately 326 systems. System data were not available for 10 multi-system water utilities that do not use single-tariff pricing.

Several states have jurisdiction for only one multi-system water utility. States with 10 or more multi-system utilities are Connecticut, Florida, Louisiana, North Carolina, Pennsylvania, Texas, Washington, and West Virginia. Of these states, only Louisiana has not approved single-tariff pricing.

As shown on page 13 of Exhibit No. JAB-6, based on the available data, the number of systems managed by the multi-system utilities ranges from 2 to 201. The average number of systems reported is 11; the median number of systems was 4. The number of connections for the smallest system ranged from 2 to 30,000, with an average value of 751 and a median value of 30 (based on data for 115 systems). The number of connections for the largest system ranged from 18 to 329,000, with an average value of 11,615 and median value of 257 (based on data for 115 utilities). The earliest date reported for adopting single-tariff pricing was 1958; the most recent date was 1995. The average and median time frame for adopting single-tariff pricing was the early 1980s.

At the time of the survey, single-tariff pricing had been partially implemented for several systems. In some cases, all but a few systems are placed under a single tariff; in other cases, the single tariff is being phased-in gradually over time. In addition, single-tariff pricing proposals were pending before two state commissions (Massachusetts and New Jersey). Only one commission reported that monitoring and evaluation of single-tariff pricing had occurred in the form of reexamining past rate cases (West Virginia).

Q. Did you compare single-tariff utilities to multi-system utilities without a single tariff?

A. Yes; the results are presented on page 14 of Exhibit No. JAB-6, and in Exhibit No. JAB-7. Data on the smallest and largest connections were available for 115 utilities (80 single-tariff utilities and 35 multi-system utilities without single-tariff pricing). All available data were used to preserve as much information as possible for the analysis. For data reported as a range of values, an average was used (for example, "8 to 9" was replaced with 8.5). For data reported as "<5", a value of 4.5 was used.

The sample is incomplete and nonrandom, so findings based on the available data are not generalizable. Substantial missing data will affect the results of any analysis. However, the data represent a sizable portion of the multi-system utilities regulated by the state commission. Also, many states reported a mixture of systems with and without single-tariff pricing. Certain observations can be drawn from the data that should lead to further consideration and analysis.

For example, as shown in my exhibits, single-tariff systems and multi-system utilities appear to differ in terms of the number of systems that comprise them, smallest connections, and largest connections. For single-tariff systems, the median number of systems was 5 (average value of 13); for multi-system utilities without single-tariff pricing the median number of systems was 4 (average value of 6). The connection data reveal more striking patterns. Along every measurement (except for the minimum of 2 connections for the smallest systems for both utility types), single-tariff utilities appear to be much smaller in terms of both smallest and largest systems based on connections.

This finding is very consistent with the perception that single-tariff pricing is most needed, and perhaps most justified, when numerous very small water systems are involved. These data may indicate that commission approval of single-tariff pricing may take into account these basic descriptive characteristics.

Q. How would you summarize current public utility commission policy on single-tariff pricing?

A. Referring back to my Exhibits Nos. JAB-4 and JAB-5, single-tariff pricing is generally accepted in eight (8) states. Texas commission staff members noted that single-tariff pricing was accepted "and preferred." In fact, the Texas commission provides a simplified procedure for merging the rates of acquired systems with the rates of the acquiring utility. While single-tariff pricing usually is requested by the regulated water utility, at least one commission (New York) has imposed its use. Pennsylvania staff noted that the use of single-tariff pricing has evolved from its application on the basis of physical interconnection to its application on the basis of common ownership.

Staff members at fifteen (15) commissions characterized the policies of their commissions as "case-by-case, " indicating that the single-tariff pricing must be justified for every specific application (even when the policy is "generally accepted"). In many states, only some of the multi-system utilities under the commission jurisdiction are implementing single-tariff pricing.

In eight of the case-by-case commissions, single-tariff pricing has been approved. In seven (7) of the case-by-case commissions, single-tariff pricing has not been approved. Three (3) of these commissions had approved partial rate consolidation for one or more utilities. Only one (1) commission had rejected a single-tariff pricing proposal.

Q. Do publicly owned water utilities use single-tariff pricing?

A. Generalizing about ratemaking for publicly owned utilities is difficult because so many variations can be found. Municipal water utilities often have a single pricing structure for all customers served within municipal boundaries ("outside" customers often pay a higher rate).

Some insights can be found from the surveys from two states with jurisdiction for publicly owned systems. In Wisconsin, where municipalities are commission-regulated, the survey noted that state law mandates single-tariff pricing for municipalities (Wisconsin S. 66.069 (1) (a) (1971)). In West Virginia, where public service districts are commission-regulated, single-tariff pricing is approved on a case-by-case basis.

Q. What arguments in favor of single-tariff pricing were identified by commission staff members?

A. Various reasons for commission approval of single-tariff pricing were provided. The primary reason for approval is presented in Exhibit No. JAB-5. Cost savings were frequently mentioned. As reported in Exhibit No. JAB-8, commission staff also were asked to identify the arguments that influenced their commissions' deliberations or policies regarding single-tariff pricing. Staff could cite more than one argument and no ranking of arguments was made.

These data reflect only staff member views, not necessarily the views or policies of the commissions. Only 21 commission staff members responded to this portion of the survey. The data exclude 6 commissions without jurisdiction, 16 commissions with no single-tariff pricing ("not applicable"), and 8 commissions that have multi-system utilities but where single-tariff pricing has not been an issue. One of the 4 is the Iowa commission, where single-tariff pricing was approved for one utility but was not an issue of significance.

In decreasing order of mentions, commission staff indicated the following arguments:

- Mitigates rate shock to utility customers (17)
- Lowers administrative costs to the utilities (16)
- Provides incentives for utility regionalization and consolidation (15)
- Physical interconnection is not considered a prerequisite (13)
- Improves service affordability for customers (12)
- Addresses small-system viability issues (12)
- Provides ratemaking treatment similar to that for other

utilities (10)

- Facilitates compliance with drinking water standards (9)
- Overall benefits outweigh overall costs (9)
- Promotes universal service for utility customers (8)
- Lowers administrative cost to the commission (8)
- Promotes ratepayer equity on a regional basis (6)
- Encourages investment in the water supply infrastructure (5)
- Promotes regional economic development (3)
- Encourages further private involvement in the water sector (2)
- Other: Can be consistent with cost-of-service principles (1)

Staff members also noted that single-tariff pricing can be consistent with cost-of-service principles (New York), that separating small-system costs may not always be cost-effective (Virginia), and that the genesis for the issue was regulatory simplification (California). Mitigating rate shock also was equated with "rate stability" (Indiana).

Typically, more than one argument will affect commission deliberations. As noted by the Massachusetts Department of Public Utilities in 90-146,

> The Parties also agree that, although the supply and distribution systems serving the communities in the Worcester County zone are not physically interconnected, several factors (viz, the contiguity of the communities served in that zone; the commonality of personnel for meter-reading, operations, maintenance, and construction duties; and

administrative convenience) are decisive in favor of treating the two Worcester County communities as a single zone in resolving the issues in D.P.U. 90-146.

Q. What arguments against single-tariff pricing were identified by commission staff members?

A. Various reasons for commission disapproval of single-tariff pricing were provided. The primary reason for the disapproval is presented in Exhibit No. JAB-5. Cost-of-service issues were frequently mentioned, although some staff also indicated that single-tariff pricing can be consistent with cost-of-service principles. As reported in Exhibit No. JAB-9, commission staff also were asked to identify the arguments that influenced their commissions' deliberations or policies regarding single-tariff pricing. Staff could cite more than one argument and no ranking of arguments was made.

These data reflect only staff member views, not necessarily the views or policies of the commissions. Only 21 responses were made to this portion of the survey. The data exclude 6 commissions without jurisdiction, 16 commissions with no single-tariff pricing ("not applicable"), and 8 commissions that have multi-system utilities but where single-tariff pricing has not been an issue. One of the 4 is the Iowa commission, where single-tariff pricing was approved for one utility but not an issue of significance; another is Wisconsin, where single-tariff pricing is required for municipalities but has not been an issue for investor-owned utilities.

In decreasing order of mentions, commission staff indicated the following arguments:

- Conflicts with cost-of-service principles (14)
- Provides subsidies to high-cost customers (12)
- Not acceptable to all affected customers (10)
- Considered inappropriate without physical interconnection (8)
- Distorts price signals to customers (7)
- Fails to account for variations in customer contributions (6)
- Justification has not been adequate in a specific case (or cases) (6)
- Discourages efficient water use and conservation (4)
- Encourages growth and development in high-cost areas (4)
- Undermines economic efficiency (3)
- Provides unnecessary incentives to utilities (2)
- Not acceptable to other agencies or governments (2)
- Insufficient statutory or regulatory basis or precedents (2)
- Overall costs outweigh overall benefits (2)
- Encourages overinvestment in infrastructure (1)
- Other (0)

Regarding unacceptability to other agencies or governments, the California staff member noted that opposition came from other utilities.

Q. What are some of the implementation strategies that are used in conjunction with single-tariff pricing?

A. Several implementation strategies for single-tariff pricing can be considered. Implementing the single tariff sometimes is accomplished in conjunction with acquisition proceedings. Utilities can phase-in single-tariff pricing for all or part of their service territory. A partial form of single-tariff pricing is to adopt a common fixed or customer charge for all utility customers, and alter variable charges based on variations in the cost of service. Utilities can use surcharges or other mechanisms to differentiate prices based on extraordinary costs. A partial approach is to develop tariffs for zones based on groupings of systems.

Q. Should public utility commissions consider implementing other regulatory approaches in conjunction with single-tariff pricing?

A. Yes. Commissions may want to consider policies in several areas. First, regulators may want to use auditing or other evaluation techniques to establish that the utility as a whole is operating efficiently and effectively. Second, the commission may to coordinate with other regulatory agencies to establish the utility's progress in regulatory compliance. Third, regulators may want to review utility planning documents to evaluate the utility's long-term strategic plans for serving customers throughout their service territories. Fourth, the commissions may want to implement a monitoring and evaluation system to assess the effects and effectiveness of single-tariff pricing. Fifth, single-tariff pricing may be appropriately considered in conjunction with alternative dispute resolution to provide affected parties a forum for participation and an opportunity to reach a settlement agreement on certain issues. Finally, regulators may want to assess the utility's efforts in educating and involving customers about the nature and purpose of water rates. These efforts may include the utility's specific efforts in building understanding and support for the rate structure, as well as other considerations (such as conservation).

Q. Do you believe the state public utility commissions should have the authority to implement single-tariff pricing?

A. Yes. Single-tariff pricing is a legitimate policy tool used by a clear majority of the states that regulate multi-system water utilities. Single-tariff pricing is a tool that can be used on a case-by-case basis to achieve what the commissions believe to be in the public interest given the evidence before them. The precarious condition of very small water systems merits the consideration of alternative regulatory approaches, including single-tariff pricing. Because of the numerous policy tradeoffs involved, only the commissions themselves can specify the circumstances appropriate for implementing single-tariff pricing. The commissions should exercise due diligence in assessing these circumstances, and I believe they are doing so. I also believe that prohibiting the use of single-tariff pricing by legislative, judicial, or other means would not be appropriate from a public policy standpoint.

Q. Does that conclude your testimony?

A. Yes.

Q (By Ms. Capeless) Dr. Beecher, have you prepared a summary of your testimony?

A Yes, I have.

Q Would you give your summary, please?

A The purpose of my testimony was to provide the Commission and the Commission Staff with a policy analysis of the single-tariff pricing issue. In preparing my testimony, I tried to accomplish three goals. One was to put the issue of single-tariff pricing in the larger context of national trends in the water industry and trends in public policy toward water utilities.

Second, was to compile data on the use of single-tariff pricing by the commissions that regulate multisystem water utilities throughout this nation.

And third, my goal was to characterize Commission policies on single-tariff pricing, as well as Staff perceptions about the key arguments in favor and against the use of single-tariff pricing.

Q Thank you.

MS. CAPELESS: We will tender the witness for cross examination.

CHAIRMAN CLARK: Mr. McLean.

MR. McLEAN: Thank you. Citizens don't have any questions but do want to thank you for that brief summary, ma'am.

CHAIRMAN CLARK: Mr. Twomey.

CROSS EXAMINATION

BY MR. TWOMEY:

Q Good morning, Dr. Beecher. I'm Mike Twomey. I represent a number of civic associations and consumer organizations served by Southern States Utilities. And perhaps by way of explanation, most, but not all of them, are opposed to what we down here refer to currently as the uniform rate structure.

Now, I want to ask you a few questions about how you came to testify for the Commission Staff, if I may. You have written extensively about the industry and served as an employee in the past of the National Regulatory Research Institute; is that correct?

A That's correct.

Q That institute is the research arm of the National Association of Regulatory Utility Commissioners; is that correct?

A That's correct.

Q You have served for a number of years both on committees of the America Waterworks Association and NARUC; is that correct?

A That's correct.

Q Is not the America Waterworks Association a trade organization for the water and wastewater industry?

A I would characterize the America Waterworks Association as a professional organization representing water utility professionals. As I understand it, memberships for the most part are individual memberships. However, clearly the association brings together water utility professionals.

Q Okay. Thank you.

And through your association with those committees, you've come to know fairly well for some six or seven years PSC Staff member John Williams?

A That's correct.

Q And John Williams serves with you on two of those committees?

A Yes. That's correct.

Q Now, additionally John Williams is one of the Staff contact persons that you had tried to maintain contact with around -- through the commissions in the United States, right?

A Yes, that's correct.

Q And Bill Lowe is one of your other contacts here?

A Yes.

Q You told me in your deposition, did you not, that for some years the case history of this case -- I take it meaning the uniform rate decision -- has been talked about generally in the regulatory community, and that as a consequence, you were aware that the Florida Public Service Commission had approved uniform rates.

A Yes. I was aware of the issue and the case.

Q Okay. Now, sometime in the fall of last year, that is 1995, you met John Williams in Orlando at a seminar or conference and he broached the subject of testifying in this proceeding; is that correct?

A No. John Williams contacted me in the fall by phone about the possibility of testifying. We did not meet in person until Orlando which was in January of this year.

Q I see. And did he tell you in discussing testifying in this case that the Public Service Commission had specifically approved uniform rates for SSU in the 1993 rate case?

A I can't recall the details of our conversations, but I think he gave me a broad history of the case.

Q Did he in that broad history tell you that subsequent to approving uniform rates for Southern

States initially, that this Commission held an investigatory docket to examine the appropriateness of uniform rates for Southern States?

A I cannot recall if he specifically told me that.

Q Okay. Did Mr. Williams tell you that he had at some point in these proceedings filed testimony -- and by "these proceedings," I mean the series of cases -- that he had filed testimony in support of the uniform rate concept?

A No, I don't recall him telling me that.

Q Do you recall whether the Staff supplied you with copies of testimony in those proceedings?

A In the prior proceedings?

Q Yes, ma'am.

A No, they did not.

Q Now, just by way of definition, what I'm referring to as uniform rate structure here is really a misnomer, isn't it?

A We often use the term uniform rate to refer to specifically the rate design whereby we charge the same price per unit of water consumed or other utility products so to avoid confusion between uniform pricing in that regard versus uniform pricing in which you're referring. I've used the term single-tariff pricing.

Q All right. And isn't it true that the single-tariff pricing means the same tariff rate for all customers of a utility at all of its systems irrespective of whether the systems are interconnected, and also irrespective of whether their cost of providing service are the same or not?

A That's consistent with my definition, yes.

Q Okay. I want to get into this in a little more detail in a moment, but in your experience don't you typically refer to a utility as the corporate entity that owns utility systems, water and wastewater systems?

A Yes.

Q And as a subcategory within a utility, isn't it true that you typically refer to the geographic service areas of the plant within the geographic service areas as systems?

A Yes.

Q Now, Dr. Beecher, I apologize and I may come to it later in my notes here, but in one of your publications you refer to a United States Environmental Protection Agency Regulation, or some document, that defines systems in that way. Do you recall that?

A Yes, in general.

Q I'm sorry, so you don't know the specific cite?

A I don't have before me the EPA's formal definition of a water system; but as I understand it, it is for the most part a stand-alone operating system.

Q Okay. In any event, you met with John Williams in January of this year in Orlando at some type of conference, and it was resolved then that you'd go ahead and prepare testimony; is that correct?

A That's correct.

Q And in doing that you prepared a survey, correct?

A That's correct.

Q But prior to your survey going out -- and that survey is attached to your testimony?

A That's correct.

Q Prior to your survey going out to the various Commission staff's, you had an opportunity to review the survey sent out by a Florida Staff member, Troy Rendell, in a earlier case; is that correct?

A I drafted my survey. I provided a review draft to the Commission Staff members with whom I was working and counsel, and after that, they provided me with a copy of the prior survey. And I did receive that prior to sending out my survey, correct.

Q And the Florida PSC Staff had an opportunity to review your survey draft?

A The Florida Staff who had an opportunity to review my survey, to my knowledge, were Jennie Lingo, Joann Chase and Lila Jaber.

Q Yes, ma'am. Much of your testimony is devoted to a fairly generalized discussion of the history and current status of the water and sewer industry in the United States. Would you agree?

A Yes, that's correct.

Q Additionally, you have discussed at some length the responsibilities of the Florida PSC for regulation as well as to some lesser degree the roles of the environmental agencies in the state of Florida, right?

A Yes.

Q And then you discuss the issue of single-tariff pricing. And you note on Page 16 of your testimony that you haven't written exclusively on this subject, but you've mentioned it in two of your previous reports, correct?

A Correct.

Q Now, I want to be clear from the outset, you are not here through your testimony, are you

Dr. Beecher, to endorse the concept of single tariff rates?

A That is correct.

Q Rather, you are here to provide some explanations or alternatives to this Commission for their consideration. Is that generally correct?

A Yes, that's correct.

Q I've got a -- in that regard I want to ask you some questions about some of your writings.

MR. TWOMEY: Madam Chairman, I've got a document, if I could have a number, "Cost Allocation and Rate Design for Water Utilities, December 1990."

CHAIRMAN CLARK: Okay. Cost Allocation and Rate Design for Water Utilities, the National Regulatory Research Institute dated December 1990, will be marked as Exhibit 133.

(Exhibit No. 133 marked for identification.)

MR. TWOMEY: Thank you, Madam Chairman. Let me be clear so there's no misunderstanding, this is not the entire document, and I don't mean to purport that it is. It is excerpts that I have selected, and I don't have any -- I'm not opposed to anybody putting the entire document in. It just became burdensome to attempt to try and do it and expensive as well.

Q (By Mr. Twomey) Do you have that?

A (Nods head.)

Q Would you turn to Page Roman IV at the bottom, please?

Okay. Doctor, if you'd look at what appears to be the first full paragraph, close to the middle of the page, you say that "the Theoretical pricing standard is to set rates equal to the cost of service. That is rate differentials are based on cost differentials."

And my question to you is first of all, you co-authored this report; is that correct?

A That is correct.

Q And isn't it true that you believe that that's the correct theoretical pricing standard?

A I think that is a guiding standard in ratemaking, yes.

Q If you know, isn't it the guiding ratemaking standard in the industries concerning water and sewer, electric utilities, and natural gas utilities?

A Yes. I think it's a prevailing standard in the public utility pricing literature.

Q Perhaps with the exception of the telecommunications industry, would you agree?

A I think currently it's hard to draw broad conclusions about current regulatory and pricing standards in some of the industry.

Q Do you think that using cost of service as a pricing standard for ratemaking in the water and sewer industry is the appropriate standard to use absent some significant justification for a departure from it?

A Certainly in setting revenue requirements the cost of service is a critical consideration. The purpose of regulation is to substitute for the marketplace or for government ownership.

Q Okay. Now, you said revenue, "in setting revenue requirements," right?

A That's correct.

Q As distinct from setting rates?

A That's correct. I would distinguish the role of cost of service in determining the revenue requirement from specific rate design alternatives.

Q Okay. Now, would you turn to Page 7 of that document. Under the "Price of Water" heading, your report states that prices that accurately reflect costs send correct signals to consumers about the value and cost of water, and thereby encourage wise use and discourage wasteful consumption."

Do you adopt that statement?

A Yes, I do.

Q And if that's correct, Dr. Beecher, doesn't it stand to reason that prices that do not accurately reflect costs would of necessity send incorrect signals to consumers?

A As a generalization, that's correct.

Q Yes. And that also that prices that did not accurately reflect costs could encourage wasteful consumption and discourage wise use?

A That's correct.

Q Especially in those cases in which the cost was less -- I'm sorry. Especially in those cases in which the rate was less than the cost, right? I'm sorry, let me finish. You would expect that wasteful consumption would result more likely from a situation in which rates were less than cost as opposed to the situation where rates were higher than cost, right?

A That is correct.

Q So let me ask you this: If a Public Service Commission was truly concerned about encouraging water conservation, they would make every reasonable effort to have the rates charged reflect costs; is that correct?

A If regulators were concerned about encouraging conservation, they would certainly pay attention to the pricing signal, but they would also probably consider other incentives for water conservation.

Q What do you mean?

A Water is relatively price inelastic commodity, meaning that consumption responses to changes in price may not be substantial. Therefore, it's frequently recommended that to encourage conservation, water pricing is used in conjunction with other kinds of programs, including consumer education; retrofits, for example.

Q Low-use shower heads, toilets, that type of thing?

A Exactly.

Q Now, there is a part of your report here, Exhibit 133, talks about the advantages of marginal pricing, marginal cost pricing, right?

A That's correct.

Q And if I can attempt to summarize it, don't you -- isn't it your view that marginal cost pricing is "better", quote/unquote, because it more accurately sends true cost price signals to the consumer than average type costing?

A I believe what we've tried to address in this report and elsewhere is the idea that theoretical marginal cost may not be easily implemented, but that incremental cost or costs that do reflect the cost of providing additional units of capacity are appropriately used to send correct price signals.

Q Okay. Again just to be clear, and that's because the incremental cost more accurately reflects the true current cost of the service provided than traditional methodologies; is that correct?

A It provides, I believe, what in economics we think is a more appropriate reflection of the economic value of the product. There is a challenge in reconciling that approach with determining revenue requirements assigned and there are techniques that can be used to do that.

Q Okay. Would you look at Page 8 of the document, please? Near the bottom you say that "Pricing and resource conservation are inseparable issues because of the relationships of price to quantity demanded. From the viewpoint of economic theory, price is essential to the appropriate valuation consumption in conservation of resources." Right?

A That's correct.

Q Without correct price signals, consumers may overconsume or underconsume water. Now, it's not my intention to beat a dead horse here, Dr. Beecher, but

I want to make sure I understand the thrust of what you're saying there. You are saying, are you not, in that last statement, that if consumers receive an incorrect price signal by having a rate that doesn't charge them the complete cost of their service, that they might overconsume, correct?

A That is correct.

Q And the converse is true that a customer that is charged a rate that exceeds the true cost of the service might, as a result of that overcost, consume too little.

A From an economic efficiency standpoint, yes.

Q All right. Now, the -- I'd like to ask you to look at the perspective Table 1-1 on Page 10. From the Utility's perspective, in terms of being fully compensated so that its revenue requirements are met, if the rates are designed properly, it should be -- a utility should be indifferent, should it not, with respect to this one category, this one factor, it should be indifferent between so-called stand-alone rates or single tariff rates. Would you agree?

A In terms of narrowly, the issue of compensation, I guess that would be correct.

Q Yes. And likewise the same would be true of the second factor, would it not? If the first is true, the second should be true, right?

A That is correct. Assuming that the rate structure in itself does not affect the ability to earn a return.

Q Can you think of any reason that you would adopt as your own why a utility should differentiate between uniform rates and stand-alone rates in considering the third criterion listed there.

A I'm sorry, could you repeat the question?

Q Yes, ma'am. Can you think of any reason why a utility should not be indifferent to single-tariff pricing or stand-alone pricing when it considers the third perspective?

A I don't think, according to this third perspective, that the Utility would be indifferent. I think one of the rationales for single-tariff pricing is to better position a utility for competition and long-term planning considerations by, for example, economizing on planning and regulatory expenses, and so on. And, also, there could be advantages in terms of load management perhaps.

Q Well, let me ask you this. Load management typically is a term used primarily in the electric utility industry, right?

A That is correct, although I think it is a term that is increasingly used in the water industry.

Q Would it have any applicability between and amongst noninterconnected water or wastewater utilities?

A Generally, physical interconnection would be required to practice conventional load management technique. However, again taking a long-term view and looking at systems as a whole, I think one of the potentials for regionalization would be some physical interconnection.

Q But absent interconnection, you would agree, would you, that load management is out completely?

A For the most part, yes.

Q Okay. Now going to the customers perspective, the customer wants to see that the ratemaking process and the rate structure are equitable, correct?

A Correct.

Q The ratemaking process, I assume, meaning the hearing process, right?

A Correct.

Q In terms of rate structure, do you mean by equitable that the rates are fair, just and reasonable, and that they are not unduly discriminatory?

A I think in the regulatory realm that's how we might define equity. However, I think consumers might have varying definitions of equity based on their particular circumstances.

Q Sure. But within the context of virtually the statutes of all of the states of this country, the fair, just and reasonable and not unduly discriminatory is the legal standard, is it not?

A That's my understanding.

Q Okay. And consumers want rates to be affordable, right?

A I believe they do.

Q Okay. Do you know of any objective way of measuring affordability?

A I think there have been attempts to measure affordability through objective means by, for example, looking at income characteristics of an area and the percentage of income required to pay for utility services. This has been used in the energy utilities and is sometimes now used in water utilities. It's an issue that health regulators care about in terms of whether or not water systems can have rates that support the cost of complying with the drinking water regulations.

I do not feel we have as a matter of public policy a clear standard on affordability.

Q But would you agree with me that to be usable, even if you accepted the notion that one would have to measure incomes in their service areas -- that is to say, in order to know what a person can afford or not, you have to know what their income is, right?

A Income or wealth, yes.

Q Okay. Now, the -- I'm going to skip the third one about understandability, unless you would like to comment on it, and move to society's perspective. And by the economic efficiency of the rate structure, are you referring to the earlier notion that consumers should have the proper and correct price signals and not be led to over- or underconsume?

A That is correct.

Q The appropriate valuation in conservation of resources, I think we've already talked about conservation of resources in terms of price signals, what does the appropriate valuation mean, or is that one and the same?

A It's a bit redundant with the idea of economic efficiency.

Q Okay. How can you take into account priority uses of water through a ratemaking procedure?

A I think traditionally in pricing we consider, for example, the importance of maintaining the utility's obligation to serve, and there is a prioritization of water uses in terms of our drinking needs, our sanitation needs, and moving on down the line toward, for example, commercial and industrial and agricultural needs. So that could reflect that notion. But in general, I mean, that's subject to interpretation.

Q Okay. We had discussed the notion that in your deposition that it is your general belief, as I understand it, that you are opposed to the concept of subsidies within utility rates generally; is that correct?

A I think for subsidies to be used they have to be explicitly recognized and a justification has to be provided for their use.

Q But in any event, at least in a theoretical sense, any subsidy results in a degradation of the rate being able to reflect cost; is that right?

A That's correct. Subsidies that provide revenues outside of the utility rate structure, or subsidies within the utility from one class of customers to another will tend to undermine the price signal to customers.

Q Okay. And by outside subsidies you typically would think of a municipality -- a municipal type system that either uses its system to subsidize other municipal services or one that uses other services or general revenues to subsidize the utility's services, right?

A That is correct.

Q And I think I hear you saying that that's -- are you saying that that's okay as long as it is specifically stated?

A In general it's not preferable to use subsidies. However, communities I believe have to make that determination themselves if they find for example, that supporting certain costs through means other than the rate mechanisms is appropriate under certain circumstances. Ultimately it does come down in part to the communities weighing the subsidization issue against other public policy issues.

Q Yes, ma'am. But isn't it your point that even if they do that, that if you have a municipality for example, that subsidizes its water rates with general revenues, the necessary result is that consumers will have a price signal that does not accurately reflect cost, and in that situation would be likely to overconsume water; is that correct?

A That's correct. The concern is that over the long run consumer consumption patterns would not reflect their use of the correct price signal and, therefore, the utility as a result might overbuild capacity in response to inflated demand.

Q Okay. Now, the second type of subsidy that you mentioned, did you say that it was between classes of utility customers or among or within a class?

A I believe I was referring to among classes of customers or classes of service.

Q Okay. Would that be a situation in which a bulk or industrial customer might be charged marginally above cost of service or above parities, as you might refer to it, in order to supply some subsidy to a residential class?

A That would be an example.

Q Okay. Now, is that, in your view of this industry, is that desirable or not desirable?

A The ratemaking process always involves some kind of averaging to arrive at classifications of customers in service. We don't have individualized rates. So from a very narrow theoretical standpoint, there's always some element of subsidization involved in ratemaking.

I think the general guiding principles

suggest that we align classifications of service with the costs of providing those services so that the overall subsidies are generally minimized.

Q Yes, ma'am. But to the extent that a bulk customer or a classification of bulk customers or commercial customers are overcharged relative to their true cost of service, in a economic sense, they will tend to underconsume; is that correct?

A Yes, if that's true. Although I would also suggest that pricing of wholesale versus retail customers in the water industry is probably not at the level of understanding and analysis as it is in the other industries, and it's something I think we need to know a lot more about.

Q And conversely, in that situation the consumers, the residential consumers, who are being charged a rate that is less than their cost of service as a result of the interclass subsidy would tend to consume more water than they otherwise would if they had the correct price signal, correct?

A That would depend on the elasticity of demand for those particular groups, bearing in mind that residential use generally is less price responsive than the use by industrial class customers.

Q Right. Wouldn't you agree with me that the -- irrespective of what the elasticity was for a given income group, that that would be affected as well by the magnitude of the subsidy, right?

A Could you repeat?

Q Yes. How much a class of customers might overconsume or underconsume as a result of either paying a subsidy or receiving a subsidy depends in large part on how large the subsidy is relative to the real cost, right?

A Yes.

Q So that a residential customer that receives a very large subsidy as a percentage of his or her true cost rate might overuse a lot more than someone that is getting a minimal subsidy, right?

A Absent other information or conservation oriented programs directed toward that consumer, that is correct.

Q Are you aware that -- I'm sorry, let me go back.

When typically -- first of all, your specialty is by and large in the water and wastewater industry; is that correct?

A That has been my concentration for the last several years.

Q But isn't it true that your knowledge of utility ratemaking goes beyond that, and you are generally aware of ratemaking in the other industries?

A In general.

Q Okay. Isn't it true, Dr. Beecher, that one of the things that you get when the relative parity or the subsidy that flows from one group of customers to another gets too large, you start -- regulators typically worry about the rates becoming unduly discriminatory, do they not?

A That's correct. I think regulators evaluate due and undue discrimination.

Q Right. And isn't it generally true that, for example, in the electric industry that there is an industrial rate not because you have a group of people that are industrialists or they have big buildings or furnaces, but because the cost of providing them service is sufficiently different than the cost of providing other groups of customer service, like residential?

A I think the rational for industrial rates has been made largely on the basis of cost of service. Differentials which, in turn, are dependent on demand characteristics.

Q Okay. And isn't that generally the basis for in the water industry, or the wastewater as well --

A I believe it is.

Q -- the basis for charging different rates to bulk customers versus residential?

A Yes, I believe it is. Although, again I would argue that our knowledge about those cost differentials could probably be improved from any service territories.

Q By that do you mean that we need to refine our ability to measure those cost differentials?

A Yes.

Q Okay. Now, in the instant case, Dr. Beecher, there are something in excess of 140 separate water and wastewater systems that are owned by this Utility that are scattered throughout the state of Florida. Very few, I think some six or eight, are interconnected, okay? Now, the Company -- it is my view, I think it's evidenced in the case already, that the Company keeps separate books and records, account records, pursuant to the NARUC system of accounts for each of these separate geographic service areas, as they like to refer to them, as well as they keep plant accounts and separate O&M accounts pursuant to the system of accounts. And given that, the cost of service for each location can be ascertained with a high degree of accuracy. I want you to accept that as the premise for my question.

If that is true, and some of these systems have high cost of service and some have very high cost of service and some of them low, do you find it objectionable to merely average all of the rates?

A I can't say that I find it objectionable. I have not studied the data in this particular case to make that kind of a judgment.

Q In terms of meeting the objectives of sending a correct price signal, would you find it objectionable if a system's customers were being charged rates for water or wastewater service that didn't even cover the cost without including an allocation for return on investment?

A Again, I would not use the term "objectionable," unless you mean the narrow sense of can one object on the basis of participation in a proceeding such as this.

I would say that that condition cannot be evaluated in isolation from the several tradeoffs required to make that rate design determination.

Q Okay. And what are the tradeoffs that you refer to, Dr. Beecher?

A The literature on ratemaking tends to

provide a litany of principles that we recognize as important, and we also recognize there's a certain degree of tension among those principles in setting rates. At the top of the list is the concern about economic efficiency that we talked about. But other principles include equity, administrative feasibility, institutional legitimacy, consumer understanding and acceptance, affordability even.

So taken as a whole, I believe that regulatory bodies look at rate design decisions and recognize at times that not every goal can be perfectly achieved.

Q Yes, ma'am. But you recognized in that statement that economic efficiency is head and shoulders, the preeminent consideration, is it not?

A I think it is. I think it is an extremely important consideration. But I also believe that the reason we have policymakers and regulators is to make hard choices, and at times that may include evaluating efficiency goals in the larger context. And I would add also, in addition to the ones I mentioned earlier, the revenue sufficiency on rate stability goals that are inherent to the ratemaking as well.

Q Okay. But you would agree with me, would you not, that regulators, including these

Commissioners, are not free to make -- let me rephrase that -- that they are constrained to make their hard choices within the confines of the law, right?

MS. CAPELESS: Objection. The witness is not qualified to answer.

MR. TWOMEY: I don't know that she's not, Madam Chairman. She's a recognized expert in this field.

CHAIRMAN CLARK: I'll allow her to answer that in the context of her, at least when it comes to the law, a layperson's knowledge.

CHAIRMAN CLARK:

WITNESS BEECHER: Could you repeat the question?

Q (By Mr. Twomey) Yes, ma'am. You mentioned that Commissioners have to make hard choices. And my question to you is simply, aren't regulatory bodies, including this Commission, restricted to making those hard choices within the confines of the applicable law?

A In my experience as an advisor, a staff advisor to commissioners, and as a researcher, I have found that, yes, commissioners certainly have to be aware of the parameters in which they operate. Those include legal standards and also analytical standards and economic standards that we've talked about. However, I also think there are times when it is appropriate for commissions to, if you will, test the limits and the boundaries of their authority, and we have to have a degree of confidence in the courts to point out to them when they maybe have gone beyond an acceptable approach.

Q That's fine. But by that do you mean that commissions should seek to push the envelope and see what they can get away with absent constraints by the Courts?

A No, I didn't mean to advocate that position at all.

But I think administrative policy and law tends to have a degree of latitude for decision making. And some issues ultimately do have to be tested before the Commission and before the Courts.

Q Okay. You mentioned a number of considerations at which you placed the economic efficiency at the top, and I think you said equity next. And I'd like to ask you what place equity has in ratemaking.

A You mentioned earlier the notion of just, fair, reasonable. I believe I've also seen the term compensatory used.

Most public utility commissions operate with a preamble or language in their enabling legislation that refers to some concept of fairness or equity. It's an extremely difficult concept to operationalize or develop specific guidelines for.

So while I think it's hard to place any relative weight on any of these criteria, I certainly do think it tends to appear time and time again.

Q I know you're not a lawyer, but you're probably more familiar with regulatory schemes across the nation than anyone else in this room. Are you aware of any regulatory statute that contains the word "equity"?

A I would rather not venture a guess on that answer.

Q Okay. How about "administrative efficiency," Dr. Beecher. Are you aware of any statute that lists as one of the guiding principles for rate setting administrative efficiency?

A The principles that I was citing, I think, speak more to rate design issues, as compared to general regulatory frameworks that appear in statutes.

My understanding, in very general terms, is that statutes are going to be somewhat less specific on providing guiding principles for actual rate design.

Q Let me ask you this. Hasn't it been your experience, Dr. Beecher, that almost without exception that regulatory rate setting bodies in this country for water and wastewater attempt to set rates that reflect cost of service?

A Yes, I believe they do.

Q Okay. Can you name me -- how many specific examples can you name me where they have strayed from that intentionally?

A I would not suggest that any public utility commission intentionally strayed from the basic notion of cost of service, particularly if you're referring to determination of the revenue requirement. But I'll refer to my testimony in terms of the use of single-tariff pricing in terms of a substantial number of commissions that have found it appropriate to implement that policy in terms of spreading the cost of service evenly across customers through a single-tariff price.

Q Okay. Let me can you a couple of questions about your survey. Your survey went out to your contact staff persons throughout the county, right?

A That's correct.

Q And you faxed it to them?

A That's correct.

Q And asked for a rapid response?

A That's correct.

Q Your compendium or your analysis that's attached to your testimony is based upon your review of what the materials you received in response to your survey, right?

A That's correct.

Q You don't claim to have, nor do you have, any independent knowledge of the information that was given to you in those responses; isn't that correct?

A That's correct. Only to the extent that in a few cases additional documentation was provided by Commission Staff.

Q Okay. And for the responses that you receive where they indicated that the commissions had approved single-tariff rates, do you know for a fact what the cost of service was between the systems involved in the -- for which single-tariff rates were set?

A No, I don't.

Q So isn't it true that you can't tell me or you can't tell this Commission that where another state approves single-tariff pricing, that there was no cost differential amongst the systems involved;

that the differential cost of service was 5%, 10 or 80%; is that correct?

A I think we can assume a differential, but we do not know the magnitude of that differential.

Q Why can you assume a differential? Isn't it possible that the rates, the cost of service for the systems involved could be identical?

A Yes, it would be possible, but unlikely that it would be perfectly identical.

Q Is there any basis you have for -- strike that.

In your experience, do you have any percentage number that you typically would find where a Commission would draw a new class of customer based upon cost of service differential? Do you understand my question.

A Yes, I do, and no. The answer is no.

Q Is there a point of discrimination that is sufficiently high that you think it would demand a different class? For example, if there was a 50% differential in cost of service between two systems, that that would cry out for a separate rate?

A I would not select a number to make that determination.

Q Okay. Again, your survey results don't suggest that discrimination of any level is okay. You're just here to report, based upon the information you received to your survey, that X number of states said they did single-tariff pricing, right?

A My goal in conducting the survey was to identify instances of the use of single-tariff pricing.

Q You're not supporting that, you're just reporting it?

A Not supporting the issue.

Q Yes. You're not supporting what any of those states did in the cases in which they adopted single-tariff pricing, you're only here to report the results obtained from your survey, correct?

A That is correct.

Q Now, would you turn to Page 16 of your exhibit -- my exhibit. The last full paragraph, at the bottom of 16 says, "Generally the cost of service standard has prevailed in setting water rates. This means setting rates that generate revenues from each user group equal to the cost of serving that group. That is the user class that causes the expense absorbs the cost in rates paid for water service. The cost of service concept implies equal treatment for users with equal costs and rate differentials reflecting cost differences. This presumes, however, that water service costs are easily ascertainable for specific user groups." Now you believe that, don't you?

A Yes, I do.

Q So would you agree with me, Dr. Beecher, that if this Commission can ascertain cost and rate differentials or cost differences amongst the several systems owned by SSU and that are part of this case, if they can ascertain specific cost differences that are easily ascertainable, you would recommend to them that they set rates that reflect those cost differences, right?

A If the cost differentials are ascertainable, that indicates that rates can be set in a manner that differentiates on the basis of cost. It's not necessarily prescriptive. It merely would point out to regulators that they can in the context of all of the evidence before them, make that determination and differentiate rates based on cost.

Q So you're not prepared to state that if there are easily ascertainable cost differences amongst these systems, you're not prepared to state that this Commission should set different rates to properly reflect those different costs?

A I think that information in and of itself only suggests that they can. But again is not prescriptive.

Q Okay. In your testimony, Dr. Beecher, you talk about -- let me find it. You talk about the fact that there were -- the problems with the proliferation of water and sewer systems in the United States, right?

A Yes.

Q Okay. Where is that in your testimony, if you could -- I have -- (Pause)

A I believe on Page 6, I refer to that issue.

Q I'm sorry. Thank you.

Now, you recognize specifically, don't you Dr. Beecher, both I think in your testimony here and in your other writings, that there are a great many more utility systems than there are utilities, right?

A That's correct.

Q And the -- you also testify that the -- while the number of regulated utilities in the United States has tended to change, that by and large the number of systems has remained reasonably constant; is that correct?

A I don't believe I've been able to come to that conclusion given the available data.

Q Okay. But I'm sure I stated that too

broadly, but by and large the reduction in the number of utility companies is due to the fact that utilities, usually larger utilities, have acquired other utilities and absorbed their systems, right?

A I believe that's correct. We don't have systemic data to indicate why the number of utilities has declined.

I would clarify, though, that based on the available data that we do have, both the number of systems and the number of utilities have declined somewhat.

Q Okay. In your 1995 inventory of Commission regulated water and wastewater utilities --

MR. TWOMEY: I apologize, Commissioners. I did not bring copies of all of these documents, but we could get them later, I guess, if it's necessary.

Q (By Mr. Twomey) Florida is one of the leading states in terms of the number of utilities, right?

A That's correct.

Q You show that at Page 2, 210 systems.

Now, that number of utility systems, Dr. Beecher, for Florida is down substantially, is it not, from the number of utility companies that were in the state a decade earlier?

A Based on the data available to me, that's correct.

Q In fact -- and I've lost my place here. But they typically -- I think the figure was in excess of 300 in the 1980s; is that correct?

A The inventory report on Page 12, Table 5, indicates that in 1989 Florida regulated approximately 288 water utilities, and in 1995 regulated approximately 210 utilities for a decline of approximately 78 utilities.

Q And by 27%, right?

A Correct.

Q Now, in your experience, to the extent that you have the data, was due primarily to acquisitions and mergers, right?

A I don't have systemic data to explain the decline in the number, but my understanding is mergers and acquisitions are leading causes of the decline.

Q Okay. At Page 8 of that 1995 inventory, you state under the title "Water Systems in the United States," the first sentence says, "The state public utility commissions typically count water utilities, but not necessarily water systems. The U. S. Environmental Protection Agency and the state primacy agencies count noncommunity and community water systems and record these data in the federal recording data system." Right?

A That's correct.

Q On the next page, Page 9, you say, "The distinction between utilities and systems can be important in that some utilities encompass multicommunity water systems particularly in certain states. The leading example is Florida, where 210 regulated water utilities provide service through 1,363 community water systems."

A That's correct.

Q So irrespective of any local legalities, Dr. Beecher, would you agree with me that in the sense that you're describing utilities and systems in your inventory, that SSU in this case is a utility company with some 140 or 150 or more water and wastewater systems?

A I would interpret my data to say that they reported SSU as one utility and then that number of systems, and that would be reflected here.

Q Okay. In fact, on Page 10, you state -- under the title Change in the Number of Regulated Wastewater Utilities 1989 to '95, that significant declines in regulated wastewater utilities can be observed in Florida and Kentucky and you describe gains in other states. Right?

A Correct.

Q Now, I don't intend to go through each part of this -- pardon me. I want to ask you some questions from your Viability Policies and Assessment Methods for Small Water Utilities. Do you have that?

MR. ARMSTRONG: Madam Chair, could I request a copy of the article he's referring to?

CHAIRMAN CLARK: Mr. Twomey, do you have a copy to give Mr. Armstrong?

MR. TWOMEY: I'm sorry, is he asking me for a copy?

CHAIRMAN CLARK: Yeah.

MR. TWOMEY: I don't have a copy.

MR. ARMSTRONG: Madam Chair, I object. Obviously, I should be provided a copy of anything that he's going to provide to a witness so that I can have the same information available to me.

CHAIRMAN CLARK: Mr. Twomey had indicated to me before that he had some documents that he wanted to -- or publications; is that right, Mr. Twomey?

MR. TWOMEY: Yes, ma'am.

CHAIRMAN CLARK: I had indicated that I didn't think it needed to necessarily be an exhibit, but I do think Mr. Armstrong and Staff need an opportunity to look at what you're cross examining on. How many do you have?

MR. TWOMEY: This is the last one. This is the last document.

CHAIRMAN CLARK: Why don't we take ten minutes, and you can have the parties look at it, and we'll go back on the record. Thanks.

MR. TWOMEY: Okay.

(Brief recess.)

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CHAIRMAN CLARK: We're ready to reconvene the hearing. Mr. Twomey, you were inquiring.

MR. TWOMEY: Yes, ma'am. I think I was beginning to ask questions to the viability policies and assessment methods for small water.

MR. SHREVE: Would it be possible --

CHAIRMAN CLARK: I'm sorry, Mr. Shreve, yes.

MR. SHREVE: Can we have a second before we get started?

CHAIRMAN CLARK: Mr. Shreve, wait until you sit down and turn on the microphone.

MR. SHREVE: Let's see now, we're supposed to have a course on the lights or something before we're allowed to use the microphone.

CHAIRMAN CLARK: Yes. You, Mr. Twomey and

Mr. Armstrong are going to take the course.

MR. SHREVE: If you recall, we had some discussion for quit sometime about my concern, and I think your concern, the fact that I had a conflict of interest and could not represent the two interest groups: One interest group being more or less the uniform rate side and one interest group being more or less the stand-alone side.

The Attorney General and I have worked for some time to try and get something worked out and we've done that. And now have approval and am in a position to fund attorneys for both sides out of my office -- not out of my office, but the funds would come from me; it would be an individual contract with each one of the group.

In this situation I have, as well as I could, talked to customer groups in the different areas. Talked to Mr. Hansen the other day, and also Spring Hill representatives and different ones, and Amelia Island. And the concensus seems to be the attorneys are already representing more or less the stand-alone group would be Mr. Twomey and Mr. Jacobs. And on the other side, Burnt Store has already hired Mr. Darol Carr, and Marion Oaks and some other customer groups have met and discussed hiring an attorney and they would like to hire Mr. Joe McGlothlin of the McWhirter law firm.

I think I've made it perfectly clear that everyone understands although I would furnish the money, I have no control, no restrictions, nothing whatsoever to do with any representation they have except the fact they would represent the interest of their customer groups, which more or less are going to be uniform rates on one side, stand-alone on the other. I really have a concern that both customer groups are not represented.

We're in a position to do that at this point. In general, the customer groups have made their own choices. We've tried to stay out of that and with very little -- with no instructions, really, and I have had a complete discussion with Mr. McGlothlin on this.

If you have any questions, I think Mr. McGlothlin would like to ask you to waive the rules and make an appearance. If you have any questions, I'd like to go over them with you at this point. That's what we're trying to provide at this point and the Attorney General and I have worked it out.

CHAIRMAN CLARK: Who is the other attorney?

Mr. Carr?

MR. SHREVE: Darol Carr. He was actually hired by Burnt Store prior to us working this out, but that group has also said they would like to have him represent them. Amelia Island, Mr. Jacobs; Sugarmill Woods, that group, Mr. Twomey. They are already in. Then Burnt Store, in that group, Mr. Carr, and Marion Oaks and also that same side with Burnt Store.

CHAIRMAN CLARK: What side is that?

MR. SHREVE: Uniform rates. Which here again, you can't come in and represent the uniform rates side, but Marion Oaks very clearly, a long with probably Sunny Hills and some others, are very clearly on that side with certain groups. Sugarmill Woods and Amelia Island on the stand-alone side.

CHAIRMAN CLARK: And Mr. McGlothlin will be representing which?

MR. SHREVE: At this point Marion Oaks, City of Keystone Heights.

CHAIRMAN CLARK: Do they have a position on the rate structure?

MR. SHREVE: Uniform rates.

CHAIRMAN CLARK: I see. I was confused.

So both of these attorneys will be representing consumer groups or customer groups whose interests tend to be for the uniform rates.

MR. SHREVE: I think that's a good way to put it. There's no way you can put a lock and say everyone wants that. That their interest would tend to be on that side.

MS. JABER: Madam Chairman, we have discussed it, and Mr. Shreve has described how it would work to us. At first glance it does look like it is inconsistent with the petition to intervene rule and I wanted you to know that. But I think that if we recognize that the customers have always been represented by Public Counsel, we can just call this a change in representation so that you don't even get into the intervention requirements, and deal with the rule at all. Especially in light of we knew that Mr. Shreve has been working on this for a while.

CHAIRMAN CLARK: Okay. Any further comment? Mr. Twomey, any comment?

MR. TWOMEY: No. It's great to have Mr. McGlothlin aboard.

CHAIRMAN CLARK: Southern States.

MR. HOFFMAN: Madam Chairman, just a couple of brief responses.

Of course, the time has passed for intervening in this proceeding. So to that extent we have to state our objection to parties coming into this proceeding except for the purpose, as represented by Mr. Shreve, of supporting, or tending to support uniform rates on Issue 125 in the Prehearing Order.

So we object to participation by new parties in this docket, as articulated by Mr. Shreve, except for on Issue 125. Of course, the parties, if they are permitted to come in to participate in this case on Issue 125, they would take the case as they find it.

CHAIRMAN CLARK: There's no doubt that they take the case as they find it. And I would just question whether in fact this is a petition to intervene because it would seem to me the parties have intervened and their representation has been Mr. Shreve. And as Staff indicated, it's a change in representation. Mr. Shreve.

MR. SHREVE: I don't believe we could view it as a change in my representation because we've taken the position all along that we could not represent those diverse groups. I think Mr. McGlothlin, it's up to him, but I would think that I'd want to ask for a waiver of the rules. And, frankly, once again, I plan to put no restrictions on the representation and would want it to represent the interest of those customer groups, as Mr. Twomey and

Mr. Jacobs will be representing the interest of the customer groups on the more or less other side.

I don't believe I would be as comfortable having him represent them under the name of the Public Counsel, although I see where Staff is going on this and I don't disagree. But I think it would be better to have a waiver of the rules than allow them in. I would not put any restrictions on -- if you allow the waiver of the rules, I think the attorney should be allowed to represent their customer groups in any way they see fit. There may be issues out there that we haven't even come up with as far as the rate structure or anything else. I do not want to restrict their representation, as Mr. Twomey and Mr. Jacobs representation is not restricted.

COMMISSIONER KIESLING: I was going to suggest maybe we let Mr. McGlothlin enter his appearance so we know exactly what it is that he wants to come in for.

CHAIRMAN CLARK: Go ahead, Mr. McGlothlin, go ahead and make your appearance.

MR. McGLOTHLIN: My name is Joe McGlothlin. My business address is 117 South Gadsden Street, Tallahassee, Florida.

I request at this time that the Commission provide party status to the Marion Oaks Homeowners Association and the City of Keystone Heights. And I am entering my appearance on their behalf as their representative. I would like also to enter the appearances of Vicki Kaufman and John Bakas, B-A-K-A-S, of my firm who may be involved in the hearing should you grant party status.

I request, Chairman, that the Commission waive the five-day rule with the understanding that the parties take the case as they find it. I request there be no restrictions on their ability to take positions on the issues that have been identified at this point, as their interest may require. To that extent, I'd like to make it clear that we think that we should not be confined, as counsel for the Utility suggest, to certain issues at this point, but simply with the proviso that we take the case as we find it.

MR. HOFFMAN: Madam Chairman.

CHAIRMAN CLARK: Yes, Mr. Hoffman.

MR. HOFFMAN: We vehemently object. The whole purpose of Mr. Shreve's motion earlier on in this proceeding was to provide funds for counsel to represent the varying customer groups on the rate design issue. All customers are currently represented on the revenue requirements issues in this case by

Mr. Shreve's office.

We vehemently object to Mr. McGlothlin's clients' participation in this case on any matter other than Issue 125, the rate structure issue.

CHAIRMAN CLARK: Mr. Hoffman, let me -- would you be specific as to how you believe your party to be harmed by allowing them to enter an appearance and represent the parties indicated, and taking the case as they find it.

MR. HOFFMAN: Madam Chairman, there has already been an abundance of testimony placed in this proceeding that we have had an opportunity to review and respond to that addressed the revenue requirements issues.

At this point I think it would be unfair to the Utility to now begin -- in violation of your rules, to begin adding the stack of parties who are going to now have the opportunity, if you allow them to, to address every issue in this case, whether it be quality of service, whether it be revenue requirements, whatever it may be.

CHAIRMAN CLARK: Let me be clear. It would not be my intention to allow them to file testimony. They will only at this point have the right of cross examination.

MR. HOFFMAN: They've already testified. The customers of Marion Oaks Homeowners Association, and I believe we've had customer service hearings in the Keystone Heights areas as well, have already testified in this case.

CHAIRMAN CLARK: I guess we're missing each other. I don't intend to allow them to file any testimony beyond what is in the case already. And my question is: What harm or prejudice results to your client? They will take the case as they find it. The only thing they will have at this point is the right of cross examination to file posthearing pleadings.

MR. ARMSTRONG: Madam Chairman, if I can.

CHAIRMAN CLARK: Mr. Armstrong.

MR. ARMSTRONG: Madam Chair, I believe the rule is there for a reason, obviously, and the reason there is due process.

These parties have had an opportunity since the case began, and as we noted yesterday, we gave a newspaper notice out the day we filed this case, that they had the right to come in and participate in this proceeding. Now what we're being asked to do -- its going to come. Additional time is going to come, additional cross examination is going to occur that otherwise might not occur; the repetition that we have been dealing with is going to occur that otherwise might not occur. The rule is there for a reason and it's a very obvious reason.

CHAIRMAN CLARK: And the rule can be waived for good cause.

MR. ARMSTRONG: I don't think due process can be waived for good cause.

CHAIRMAN CLARK: I agree with that. And explain to me how your due process rights are going to be affected by waiving the rules, allowing them to intervene but taking the case as they find it, and not allowing them to file any further testimony.

MR. ARMSTRONG: Simply because we're going to have to deal with additional cross examination from additional attorneys; have to prepare our witnesses additionally from what we've already prepared them for based on what we know has happened already in discovery in this case.

I just have never heard of this occurring. I don't recall anywhere in a civil trial that I've heard of anything like this occuring, either after a trial has got going where parties can come in with -- new parties can come in during the conduct of the trial and participate. I mean, I think it's a terrible abuse of due process, and would be extremely unfair to this Utility, as it would be to any party.

CHAIRMAN CLARK: Mr. McGlothlin.

MR. McGLOTHLIN: Well, I think it's for reasons of due process that we're asking that the rule be waived. This procedural rule that was designed to cover the usual circumstances. We have very unusual circumstances in this case that Mr. Shreve has addressed. And it's for the purpose of insuring that all of the customer groups that have diverse interests of this Utility are adequately represented that we're asking for this waiver.

MR. ARMSTRONG: Madam Chair, the only unusual circumstances is the uniform rate structure issue, which Mr. Shreve has been required to excuse himself from. That's the only unusual circumstance. There is no other unusual circumstance in this case as to any other case ever. And they have had the opportunity for three years to intervene on the issue of uniform rate structure.

MR. TWOMEY: May I comment?

CHAIRMAN CLARK: Mr. Twomey.

MR. TWOMEY: In one respect, since I represent the parties that are most adversely effected by Mr. McGlothlin's clients' intervention, which I'm not opposed to, I would just state that it is a special case. That as I understand the Chair's proposed ruling, that there will be no new testimony allowed by Mr. McGlothlin and his clients. You will not allow them to raise any new issues, nor will you allow them to take any new positions, and only adopt those positions already assumed by others. There may be some additional time involved. I don't see that as a due process issue. Therefore, I would -- I'm not opposed.

CHAIRMAN CLARK: Okay.

MR. HOFFMAN: Madam Chairman, may I say one important thing?

CHAIRMAN CLARK: Yes, Mr. Hoffman.

MR. HOFFMAN: We've tried to respond to your question issue of prejudice. But I would respectfully submit to you that you phrased issue by improperly placing the burden on us.

It is Mr. McGlothlin's clients who come here late. And if you waive the rule in this case, I would submit to you there's no need for the rule anymore.

In this case the revenue requirement interests of those customers have been well represented and extensively litigated by the Office of Public Counsel. The whole genesis of this issue was rate design. I would say the burden should be placed on them to demonstrate to you, and to the Commissioners, why it is appropriate to waive the rule for the purpose of reopening this entire case to these parties rather than just reopening the case for the limited purpose of rate design, the purpose for which Mr. Shreve's motion was originally filed.

And I would say that at most, the only status that should be granted to the parties, particularly in light of the issue of the potential additional cross examination and so forth in this hearing, would be amicus status. Allow them the opportunity to file a brief addressing the rate structure issue.

CHAIRMAN CLARK: Mr. McGlothlin.

MR. McGLOTHLIN: My clients have not asked the Commission to reopen anything. We've asked party status to make sure that their interests, which are not adequately represented, are represented before the decision is made and we take the case as we find it. I don't believe that the Utility has shown any prejudice.

CHAIRMAN CLARK: All right.

MS. JABER: Madam Chairman, one of the reasons I suggested that you not even reach the rule was because we do agree with Mr. Hoffman to the degree the rule does not contain a specific provision for waiver, and we recognize that.

Two things: I think that what we're talking about is not the representation by Mr. Shreve of customers with respect to rate structure. I don't mean to imply that. But there is a theoretical representation of the customer group. What I'm saying is if you accept that, then maybe we could say that the customers, as far as rate structure and service availability, will be represented by Mr. McGlothlin and Mr. Carr.

The second point that Staff would like to make is that the purpose of this kind of representation was to be limited to rate structure and probably service availability is what the parties intend. To that degree, we agree with SSU. We think that the representation should be limited to those issues.

CHAIRMAN CLARK: Commissioners?

COMMISSIONER KIESLING: Are you inviting comments?

CHAIRMAN CLARK: Yes. Or discussion.

COMMISSIONER KIESLING: I tend to agree with our Staff attorney, that at this point in time, especially since all of these customers as to revenue requirements have been represented, that representation be limited to those issues which were originally identified in Mr. Shreve's motion relating to rate structure and to service availability charges because there has been no lack of representation on the revenue requirements issues.

COMMISSIONER JOHNSON: I had a question for Public Counsel, Mr. Shreve.

You stated that -- was there a legislative appropriation to actually fund these two?

MR. SHREVE: No. I'm going to be able to at this point take the money out of my budget and fund both sides. See, I don't want to fund one side without funding the other. So we've made arrangements for me to enter contracts with them.

COMMISSIONER JOHNSON: I was just wondering if there were not legislative guidance from whomever had approved the use of the budget monies, whether it went to the rate structure issue or whether it went to the revenue requirement issue.

Because I'm inclined to agree with Staff. You have adequately represented the parties with respect to the revenue requirement and you've stated that the problem was the rate structure issues. And at least my original intention, even when we were ruling, was whether or not we should bring in additional counsel on that issue. So I was just wondering what your intent was, and more to adequately explore your thoughts on the idea.

MR. SHREVE: My intent was, as I said all along, I have a conflict of interest. And I want absolutely no control or influence over any of the representation. If I'm going to fund one side, I want to fund the other. I'm not going to fund one against the other -- without the other.

I would intend to fund Mr. Twomey and Mr. Jacobs. From this point forward I don't know that we would -- that I'm going to be able to put any restrictions on any of their representation. They're already in the case. All we're talking about at this point is the fact that we were not able to set things up before the five days. If we were in here a few days before I guess it wouldn't make any difference at all.

I have that problem. I have committed that I will place no restrictions on it. I'm not going to get involved with their representation. My view was that they would represent the interest of their customer group, and there is no legislative guideline. That's up to me except that I had to have certain approvals before I could expend money in a way that we have never expended it before.

CHAIRMAN CLARK: Commissioner Garcia, you don't have anything you want to add to this. By my asking, don't feel pressured to say anything. I'm giving you the opportunity to say something.

(Laughter)

COMMISSIONER GARCIA: No, Madam, I happen to agree with Staff.

CHAIRMAN CLARK: All right.

It is somewhat of a dilemma, and it is something that we need to be careful about in the sense that what we do here does have influence in other cases.

But I will observe that I think this was a possibility we knew was pending. Mr. Shreve has always indicated his concern with having both sides of this rate structure issue being represented. And by the same token I think we have to recognize that we are somewhat down the line in this process. And to that extent I will grant the intervention of those parties represented by their indicated counsels, but it will be limited to rate structure and service availability.

MR. McGLOTHLIN: Very well, Chairman Clark.

CHAIRMAN CLARK: I have utmost confidence that the other issues will be well reviewed. I know Public Counsel has dedicated a lot of resources and some of his -- not to imply that all of your attorneys aren't good, but some of your best attorneys to this case, so that I'm confident that the representation of those customers will not suffer.

MR. McGLOTHLIN: We understand the ruling and we'll confine ourselves to those issues.

I'd like to ask that you provide party status under the same ruling to the Burnt Store customer group who will be represented by Mr. Darol Carr.

CHAIRMAN CLARK: Please indicate that, and tell him we look forward to seeing him tomorrow. And you too, Mr. McGlothlin. Thank you very much.

MR. SHREVE: Mr. Twomey works free on Saturdays, just in case you want to make future plans.

CHAIRMAN CLARK: I think you need to remember that, Mr. Shreve.

MR. SHREVE: I'll remember it.

CHAIRMAN CLARK: Do you understand the ruling?

MR. HOFFMAN: Yes, ma'am.

CHAIRMAN CLARK: Mr. Twomey.

MS. CAPELESS: Madam Chairman, before we reconvene, I regret to inform you that the witness had not been sworn. She needs to be sworn in and then to adopt all of her testimony that she's already said.

CHAIRMAN CLARK: Okay.

MS. CAPELESS: Sorry. (Witness sworn by Commissioner Clark.)

BY MR. TWOMEY:

Q So I guess, Dr. Beecher, maybe I should say if I asked you all of the questions that I asked you before, would your answers be the same?

A Yes, they would.

Q Okay. You have your copy of the Viability Policies and Assessment Methods?

A Yes, I do.

Q I want to ask you to look at Roman III, I just want to go through and ask you as quickly as possible, on that page you say "Controlling the emergence of water systems is perhaps the most essential of all viability policies. Without nonproliferation policies, the task of improving viability is made much harder." And you believe that, don't you?

A Yes, I do.

Q And behind that is the notion that all states are to take efforts to control the emergence of nonviable -- potentially nonviable utilities so they don't turn into trouble or failed utilities down the road, right?

A That's correct.

Q In fact, you say on the next page that barriers to market entry are necessary whenever a local economy cannot support the full cost of water service from a new water system, right?

A That's correct.

Q Can I take it from that statement that you believe that existing systems that -- economies, local economies should support the full cost of their own water service?

A As a generalization, that's correct.

Q Okay.

Q Let me ask you to go to systems, please. You list some -- a blueprint from a Pennsylvania regulator, and you talk about the necessity for incentives. I'm sorry, you list his or her statements about the necessity for incentives. Is that something that you think is necessary for a Commission to do, to encourage takeovers? That is provide incentives?

A This particular listing and others can be provided to regulators for illustrative purposes to give them a sense of the range of options they might have to provide incentives.

Q Let me ask you the question this way: One of my clients is sitting right next to me, Bud Hansen, and by way of introduction, some of his fellow residents in the back have been here, Madam Chair, on a rotational basis throughout the hearing to observe.

Do you think that it is fair -- it would be fair for this Commission to charge Mr. Hansen and his neighbors a premium for their service in order to encourage Southern States Utilities to acquire a failed utility system some place else in the state?

A It's hard for me to respond in terms of the impact of a ratemaking decision on an individual customer, or a small group of identifiable customers.

I do think the Commission can consider the incentive it provides with virtually every decision it makes, and that would include rate design determinations. And the Commission's consideration of those issues will rest in part on its view about the long-term benefits to all of the Utility's customers, perhaps including the customers who join us today.

Q Let me try and be a little bit more specific.

Would you find it acceptable, Dr. Beecher, to have this Commission approve an incentive that encouraged a takeover by SSU or any utility that involved -- inherently involved the underpricing of the newly acquired system for its service, vis-a-vis cost of service, and to support that, cause an overpricing, vis-a-vis cost of service, to my clients?

A In answering that question, to the best of my ability based on what I'm hearing, I guess I would advise regulators at this Commission or elsewhere to consider not only the rate design options they might have, but also how they are implemented in terms of being phased in or implemented in a way that mitigates against the negative impacts that such a decision can have.

Q By "phased in" do you mean within a system? Phased in rates within a system, like in a nuclear plant addition?

A That's one example or phasing in, for example, over time, or perhaps even looking at alternative rate design approaches that aren't simply the black and white issue of uniform rates versus distinctly cost of service based rates. In other words, there's a range of options.

Q I see. As long as as you're here, do you have one in mind that if you know enough about the economics of this case that you would recommend that this Commission consider?

A No, I would not make a determination in this case.

Q Okay. Would you turn to Page 12 of your report, please. And it's a table, Table 1-6. And it shows -- its title is, "States Arranged by Change in the Number of Jurisdictional Investor-owned Water Utilities," correct?

A Correct.

Q And it shows the period covered is from 1980 to 1990, and it has a column that shows the change in number of systems as well as a column that shows the percent change in systems?

A This would be the change in the number of investor-owned utilities under Commission jurisdiction.

Q I'm sorry. You're right. Utilities.

And the first-place state in terms of the largest percentage of change is Texas?

A That's correct.

Q And Florida is second, and shows that it went from 260 utilities in 1980 to 357 utilities in 1990, right?

A That's correct.

Q For an absolute raw number change of utilities of 97, or a 37% increase?

A Approximately, that's correct.

Q And you don't know the specifics of why that large increase was made in the state of Florida, do you?

A I did not attempt in this analysis to document the reason for the change for any of the particular states, although I think we have some general knowledge about why that change may have occurred.

Q Okay. And what was your general knowledge of the impetus for the huge increase in the utilities in the state of Florida during that decade?

A I would suspect that a combination of factors, demographic factors as well as public policy factors, probably contribute to that change.

On the one hand we probably saw a certain amount of growth, population growth and accompanying real estate development. Another factor, when we see a large change like that might be jurisdictional or statutory effects. For example, if in the case of Florida some of the county-regulated utilities were turned over to the Commission for regulation, brought in under the Commission's purview during that time period that could account for a increased number as well.

Okay. Because that table reflects jurisdictional by state commissions?

A That's correct.

Q Okay. Would you look at Page 26. With respect to bankruptcy in water utilities you say on that page, do you not, "That many small water systems are established on the basis of speculation about real state development and growth. Growth is essential to the success of most new firms." Then you go on and say "Lack of expected growth (namely less than full development of a subdivision) is probably the most prevalent stress for young water systems"; is that correct?

A That's correct.

Q Do you know whether or not that's one of the prevalent problems in the state of Florida, or has been?

A For that particular passage I noted a staff member response in New York on that issue. I don't recall specifically being aware of data along those lines for Florida.

Q Okay. If we were to cite to you a development in the panhandle of the state of Florida that -- where there was attempted development in excess of 20,000 acres but has only 500 customers for the water and sewer system, that might be an example of what you're talking about?

A That's correct.

Q Okay. On Page 30, Dr. Beecher, in your discussion of viability and potentially nonviable systems, you list -- actually you sum up the problems that are usually inherent, right?

A Correct.

MR. TWOMEY: And I won't do too much more of this, Madam Chair, because my throat is sore -- could I ask you to read those because the Commissioners don't have copies, starting with "Most trouble"?

A This is a quote from Mr. Robert Heater from the Brick (ph) proceedings at the NRI. "Most troubled small water systems fall into one of the following categories: One: They are obtained a 100% donation by a developer to the owner/operator of a company attempting to operate as a valid operating company.

Two: They are owned and operated by the developer.

Three: They are a shell corporation set up by a developer that he finances until all lots are sold, after which it is allowed to fold.

They usually do not have enough customers to stand-alone and generate enough money to operate effectively as a separate company, i.e., less than 1,000 customers. They were usually installed with everything at a bear minimum and they almost never have a real rate base."

Q Okay. And those factors tend to increase the chance that those systems will become nonviable, right?

A Historically that's correct.

Q Okay. And result in them having negative net income and/or negative net worth, right?

A Those are two measures frequently used.

Q Would you turn to Page 42 of your document, please. And that table, Table 2-11 --

MR. TWOMEY: Madam Chairman, since we're going through specific pages here, I'd like to ask your indulgence that before the hearing is over, that I be allowed to accumulate the pages mentioned and make an exhibit so that you or anyone else would have an opportunity to refer to it.

CHAIRMAN CLARK: We'll cross that bridge when we come to it. If you do that and offer it we will allow parties to review it and object to it if they chose to.

Q (By Mr. Twomey) Table 2-11, Dr. Beecher, purports to show the estimated number of systems in poor financial health for selected states in 1991, right?

A Correct.

Q What states leads the nation?

A In this accounting, Florida is at the top of the list.

Q Okay. And it shows, does it not, that Florida in leading the nation in 1991, had 462 small systems with negative net income, right?

A Yes.

Q It had 39 in that year that had negative net worth?

A As approximated by Commission Staff, yes.

Q Okay. These, I assume, are the same Commission Staff contact persons that you took your survey results from, or their replacements, successors?

A As far as the recent survey work, probably.

Q Yes, ma'am. So that table would tend to indicate that a number of systems or utilities in the state of Florida probably fit the mold of developer, shell corporation that you suggested earlier, right?

A Based on this we would know that they --

that there were a large number of systems with serious financial difficulty. Their particular ownership character can't be surmised from this.

Q Yes. And on you have a statement on Page 49. But you take the position, and your co-authors, that the certification process is the state's most important tool in screening systems before they actually begin operations, right? It's in the middle of Page 49, under "Regulatory Policy"?

A Yes, that's correct.

Q And that that in the lexicon of economic regulators, certification can present a barrier to market entry, right?

A Correct.

Q And you made the statement -- your publication made the statement earlier, as we discussed, that there should be market barriers in those cases where the local economy cannot support the full cost of the system, right?

A Yes. And as we explored in the deposition, I believe there should be a combination of market barrier, but also a proactive attempt to seek out the least-cost means of serving customers.

Q Okay. And on the next page you and your co-authors lay the responsibility for the proliferation of these type systems at the feet of state and local officials, right? That is, you say at the bottom of Page 50, "Despite federal interest in nonproliferation, it is a policy dependent almost entirely on implementation at the state and local levels. In most cases, water systems do not emerge without the approval of one regulatory agency." Right?

A That's correct.

Q And you go further on Page 54 and state, do you not, "The blame for the proliferation of nonviable small water systems (usually privately owned) has often been laid at the door of the state public utility commissions. 'The state PUC regulatory process has been too lenient in allowing the creation of many small water systems that were not financially viable when initiated. In the past commissions may not have presented an effective barrier for market entry into some utilities.'"

Now, it's not my intention to blame -- lay any blame at the feet of this Commission. Most of the Commissioners, of whom are relatively new compared to the decade between the 1980s and 1990. But based upon what we've seen in your tables, and your discussion of the problems, the way in which utilities become troubled, can you say -- are you willing to say that it appears that some of the problem in Florida for the large number of nonviable utilities has to be taken by the regulatory agencies that certified them?

A First, I think it's important to read into this statement that blame often has been laid at the door of the commissions. Diplomatcally, we don't necessarily say that that's supported because it may not be supported in every case. And I would suggest that one has to be careful in attributing blame, and, in fact, what is important is the combination of statutory authority, Commission decision making, but also institutional and economic and other variables that may well be outside the control of the state regulatory Commission. We often, for example, point to local zoning policies as being an important contributing factor.

And then, finally, there's simply the statutory tools that the Commission has at its disposal at any given time in terms of dealing with this problem. We know for a fact that some commissions seem to not have adequate certification authority, and so we're therefore not able to exercise it very effectively.

Q Yes, ma'am. I didn't mean to put you in a embarrassing position seeing as how you are a guest here.

But in relative terms of possible responsibility for the proliferation of systems that -- and utilities that occurred in the state of Florida from 1980 to 1990, wouldn't you agree with me, Dr. Beecher, that it is extremely difficult to assign any responsibility on Bud Hansen and his neighbors for the certification or zoning of systems that are located in other parts of the states? Do you understand my question?

A Yes. And Mr. Hansen's interest aside, we all as citizens depend on our elected and appointed officials to make decisions for us all the time in public policy. So to the extent we at times become frustrated that we haven't done a good job, it's our responsibility to act through our appropriate political channels, to make changes. So I guess I -- I'll leave it at that.

Q Thank you. Now, from what we've seen in your tables in your discussion in your text, we had a -- it appears, does it not, that we had a situation in Florida through which ineffective market barriers to entry for some potentially nonviable utilities through developer-related speculation, your tables reflect that we came to at the end of the -- we came to in the 1980s, and the early 1990s, to have a problem in the state of Florida at least as represented by nonviable negative net worth systems, right?

A I would say in the state of Florida and elsewhere hindsight is 20/20 and we became well aware of this problem and certainly is not unique to Florida.

Q While it's not unique it has occurred here to a degree.

A Yes.

Q So we are faced with a problem -- irrespective of who is at fault -- we faced a problem in the latter part of the '80s and early '90s here in Florida dealing with nonviable utilities, would you agree.

A That's correct.

Q Now, if we turn to Page 91 it appears that solutions may be at hand. Under your title of "Mergers and Acquisitions" you say -- you and your co-author say "From a public policy perspective, the merger of utilities or the acquisition of one utility by another is an attractive solution to the viability problem."

A Correct.

Q And you believe that, do you not?

A As a general idea, yes.

Q Okay. On the next page, you say the top of the page, on 92, "Acquisition activity among water systems subject to state Commission regulation in 1990 not surprisingly was most substantial in those states with many water systems, as reported in Table A-7 of Appendix A. Leading the states in mergers and acquisitions were North Carolina with 91, Texas with 70, Arizona 18, Florida 14 and California 12." Right?

A Correct.

Q You go on to list some of the factors that are key in considering takeovers. And you say that "Mergers, acquisitions and other transactions involving the assets of investor-owned and other types of water utilities generally require approval by the state public utility commission which may attach conditions to the deal." That is generally the case, is it not?

A That would be my understanding, yes.

Q Do you have any basis for knowing that that is not the case in Florida?

A Without reviewing other survey data, I can't respond.

Q You note on the next page -- I'm not going to read it, but you note that a key -- a ratemaking incentive might include acquisition adjustments.

A That's correct.

Q Or higher rates of return.

A That's correct.

Q You note on Page 105 about -- you suggest at the top of 105 that rate equalization, for example, creates winners and losers, but also tends to enhance viability?

A That's correct.

Q But you note, don't you, "However, it is possible to restructure the relationship between two weak utilities or a weak and strong utility and end up with a weak utility."

A That's correct.

Q Do you have enough -- you don't have enough information about this case to make any determination of what result was obtained here, do you?

A No, I do not.

Q On Page 169, Dr. Beecher, at the bottom of the page, in listing the principle goals of regulatory policies, you indicate that "Structural policy such as mergers and acquisitions go further in emphasizing efficiency." Right?

A Yes.

Q Now, if there were inefficiencies that resulted from mergers, then they would fail to meet the test for -- the merger would have failed then, right?

A One would question the prudence of the merger if it resulted in inefficiency.

Q Okay.

A Now, I'd like to ask you to turn to Page 191, please. I'm sorry, I think we've discussed that already. Anyways, this reflects for Florida that there were 260 utilities, water utilities, in 1980, that went to 285 in 1985, and in 357 in 1990, correct?

A Correct.

Q Perhaps it was in your '95, was it in your 1995 inventory that showed the reduction from that number?

A That's correct.

Q I'm through with that. I just have a couple other questions from your deposition and I'll be finished.

You had mentioned before, Dr. Beecher, that you were aware, I guess on a national level, of what the Public Service Commission had done here in approving uniform rates for SSU in 1993?

A In a general sense, yes.

Q In a general sense is there some type of -- something riding almost nationally on this case?

A There's been surprisingly little. Because until now I never had cause to research the specific topic. I hadn't really compiled anything and hadn't seen anything in the literature.

Q At Page 70 of your deposition I asked you "Under the right circumstances can rates be high and still be legal and just and reasonable if they reflect cost?" And you answered that they could, didn't you?

A This is Page 70?

Q Yes, ma'am. Of your deposition.

A The very bottom of the page. The Line 17 I asked you -- let me ask you this: Under the right circumstances, can rates be high and still be legal and just and reasonable if they reflect cost?

A Yes, they can.

Q Okay. And high can be -- high rates can be relative, can it not, Dr. Beecher, in the sense that if a developer low-balled rates, had them below compensatory rates for the purpose of selling lots or homes, and then went to compensatory rates, there could be a large jump, right?

A I would say high or low is always a relative term.

Q Sure. If a developer did such a thing, and that is had below costs rates for the purpose of selling his development, and then jumped them dramatically, could that jump, depending upon the size, be considered to be rate shock?

A Yes. I think a magnitude increase that I think you're referring to would potentially be interpreted as causing rate shock.

Q And if there were another developer who had reasonable levels of CIAC such that the rates were close to compensatory from the outset -- do you follow me so far?

A I believe so.

Q Do you think that it would be fair to charge the customers of the system that was set up with reasonable compensatory rates at the outset, to charge them a premium in order to help negate the rate shock that might be experienced by the customers of the system that was set up improperly?

A I'll try to answer.

I think the combination of contributions or system development charges or other up-front fees for capital in the water industry, coupled with the resulting rates, has to be evaluated in terms of fairness or equity issues. And then those factors might also play into decision making about subsequent rate changes, if I'm interpreting you correctly.

Q But -- and I apologize because it was a difficult question, but you're not saying that it's appropriate or acceptable, are you, that customers from noninterconnected systems should have -- who rates were established properly at the outset, should have to pay a subsidy to another system who is nonviable, essentially from the start, had low rates, merely because of their common ownership by one utility. You don't accept that, do you?

A I can't comment on the characterization of rates set properly. So it would depend on the circumstances. But in general that would be a consideration that regulators would have to take into account.

Q Okay. On page -- I asked you while physical interconnection -- you made the statement, either your testimony or one of your documents -- I think it's your testimony, while physical interconnection yields significant economies of scale, common management of noninterconnecting systems address financial, managerial and technical viability issues and can yield some economies. And you answered "That's correct." Right?

A That's correct.

Q So I asked you what economies of scale do you achieve by physical interconnection that you don't achieve without it. And what was your response?

A I'm looking.

Q It's at the top of Page 75 is your response.

A I responded "That with physical interconnection you can achieve economies in supply and treatment, for example, the chemical cost and other kinds of treatment costs, operating costs, and without physical interconnection you have to look for economies in other areas of operation."

Q So it stands to reason, does it not, Dr. Beecher, without physical interconnection you can't achieve the economies you just listed.

A That's correct.

Q Okay. And that isn't it true that whatever other economies you would find from centralized management would exist irrespective of whether you have single tariff rates or stand-alone rates?

A Yes. That's correct.

Q Okay. In your testimony, I think it was, you said at Page 16, beginning at Line 6, "Larger systems interested in acquiring smaller systems tend to favor single-tariff pricing." And I ask you why do they tend to favor single-tariff pricing? We're till to Page 75.

COMMISSIONER KIESLING: I'm confused. I thought you said it was on Page 17 of her testimony.

MR. TWOMEY: 16, I think. I'm just trying to point to her the answer she gave in the deposition.

COMMISSIONER KIESLING: And that's what I'm trying to figure out. Are you asking a question regarding her direct or are you just asking a question about the deposition?

MR. TWOMEY: I'm asking her a question related to her testimony.

COMMISSIONER KIESLING: Okay. And where is that testimony? That's what I'm trying to figure out. Is that on Page 16?

MR. TWOMEY: Maybe it's her --

COMMISSIONER KIESLING: It may be. I'm just trying to get the correct page. Was it 16 or 17?

MR. TWOMEY: It was 16, Line 6. It says "Larger systems"

COMMISSIONER KIESLING: I needed to know where to look. I can read once I find it.

MR. TWOMEY: Okay. I'm sorry.

Q (By Mr. Twomey) Okay. My question to you, Dr. Beecher, is why do they tend to favor single-tariff pricing?

A As answered in my deposition, it is my understanding based on anecdotal evidence, I admit, but that larger systems would generally like to have incentives to acquire small systems, especially if those systems are troubled financially. So the acquiring systems tend to look for incentives to make acquisition. And single-tariff pricing seems to be viewed as a way to make the job of the acquiring utility easier, simpler and so on. And this includes, you know, the administration of a single rate structure, simplification of related functions such as customer education, billing and other practices.

Q And isn't it true then that it also, that is single-tariff pricing, makes the utility's life easier by spreading the cost over more customers and, thereby diffusing what otherwise might be considered rate shock.

A Yes, that's correct.

Q Now, I'm not going to go to the whole thing because we've gone a long time, but on Page 16 of your prefiled direct testimony you discuss the zonal pricing, correct?

A Correct.

Q And in many regards zonal pricing is the opposite of single-tariff pricing, correct?

A That's correct.

Q And that that is to the extent that -- because zonal pricing attempts to follow cost of service dictates fairly closely, right?

A Yes, that's correct.

Q Okay. And that in some cases the -- where there are substantial spikes in costs in one geographic location, it would be appropriate for an agency to set a zonal price to regionally address that spike in price, right?

A It might be appropriate to consider a zonal price if implementing that price provided benefits that exceed the cost of doing so.

Q Okay. Didn't you say that -- in answer to my question about zonal pricing, attempting to follow cost of service dictates fairly closely. You said, did you not, the passages you're referring to come out of previous research in which we suggested that water systems or water utilities faced with substantial spikes in costs may need to consider zonal pricing, which as we said, places as emphasis on costs that are differentiated on the basis of physical differences in systems, right?

A Correct.

Q And I asked you whether or not those physical differences in systems could include their geographic location. And you said that they could, right?

A Yes.

Q Okay. In fact, you said that the geographic location is a key factor, did you not?

A It is a key factor to the extent that geographic differences may also reflect some fundamental cost of service differences, such as gravity, physical barriers to interconnection, that sort of thing.

COMMISSIONER JOHNSON: Okay. And you don't have any basis for saying that zonal pricing in this case wouldn't be more appropriate or more efficient than single-tariff pricing, do you?

A Our discussion of zonal pricing in the report, meeting water utility revenue requirements, envisioned a utility with zoness that can be highly differentiated on the basis of cost.

The analogy that the water systems in this case may not be perfectly appropriate. But the concept of zonal pricing can be helpful when one is looking at a large number of systems and the possibility, for example, of grouping systems into zones which might be defined geographically, but they might be defined on other community characteristics, for example.

So I believe in the survey I report in my testimony, the zonal concept comes up again because some commissions have implemented a partial form of the single tariff.

Q Wouldn't it be especially appropriate to engage in zonal pricing in a case in which you have in excess of hundred systems that each has specifically identified and varying costs to provide service?

A I think the choice of a zonal price system versuss the alternatives would depend again on the administrative cost; the perception of other benefits, and so on. So in other words, a myriad of factors may come into play into deciding whether or not it's appropriate.

Q Okay. Do you see any basis for not charging -- I suggested to you that the single-tariff rate in this case being proposed by SSU for residential, for example, is a straight mathematical average taken from the rates to be derived from the cost of service of all of the systems involved, okay?

Now, if that is true, do you see -- and that, therefore, that it completely ignores the cost of service considerations in my view.

If that is true, do you see any justification at all for not just charging commercial and bulk customers the same rate as residential?

A I cannot comment on the particulars of the SSU data. A mathematical average in and of itself does not ignore cost of service if that average is based on a cost of service estimate that reasonably reflects revenue requirements as well.

As to the differential among customer classes, I can't comment on that.

Q I guess my question wasn't clear. If you're going to ignore completely cost of service considerations amongst 140-plus systems for establishing residential rates; that is, ignore the differentials in cost of service from location to location to location, and merely take a straight mathematical average of those rates for the classes that have traditionally been established, residential, commercial, business, bulk, mightn't we just go ahead and make it a whole lot easier and charge everybody the same rate?

A There are utilities that do that.

MR. TWOMEY: I want to thank you for your time here today and for your deposition.

WITNESS BEECHER: Thank you.

CHAIRMAN CLARK: Mr. Armstrong.

CROSS EXAMINATION

BY MR. ARMSTRONG:

Q Good morning, Dr. Beecher.

A Good morning.

Q Obviously Southern States is the applicant in this case, but I don't consider what I'm going to be asking you here cross examination.

We appreciate your being here, and want to see that you express whatever opinions you have and whatever facts you can give to the Commission.

I want to begin by referring to Pages 10 and 11 of your testimony. At that portion of your testimony you refer to water supply a rising cost industry. And specifically you state and I'm quoting, "Water supply is among the most capital intensive of all utility sectors."

Would you agree that the rising cost situation faced by water utilities today as a result of the Safe Drinking Water Act, which I believe you cite, is analogous to the rising cost the electric industry faced in little '70s and '80s as a result of the Clean Air Act?

A In my writings, and specifically the report "Meeting Water Utility Revenue Requirements" that was referenced a few minutes ago, I have emphasized the importance of looking at the total cost profile of the Utility, and that would include compliance costs that you're referring to, but it also includes infrastructure cost and it also includes demand growth related cost. And for any given utility a variety of cost factors will be relevant.

So with that as a backdrop, I would say that rising costs, in part due to regulatory compliance issues, but also due to these other factors, in many ways do make the water industry analogous to our other utility industries in terms of facing some rather dramatic costs and other issues.

Q Thank you. Again, just the analogy to the electric utilities, I believe now that we're seeing the electric utilities -- and tell me if you agree -- now that they are coming more close to actual compliance in full with the Clean Air Act, we're seeing now a level of rate stability from the electric utilities, and we've experienced that for several years now, as opposed to what we had in the '70s and '80s when they were making the investments to comply.

Would you agree with that?

A Although it's not reflected in my testimony, one of the things I have examined recently is price indices for all of our utilities, energy, water, telephone. And I do believe there is some stabilization occurring in the energy and telecommunications industries relative to the water industry.

Q Thank you. I believe you've referred to, on Page 11, those three reasons why water supply costs are rising: SDWA compliance, replacing upgrading infrastructure and the third was to meet population growth and economic development. I understand population growth, but could you just give me an indication of what you mean by economic development?

A By that I mean the expansion of economic activity in an area, meaning most likely commercial and industrial activity. In other words, it's not simply the residential customer class but also the nonresidential customer classes.

Q Okay. When you say at Page 11, Lines 20 through 23, that these factors present -- and I'm quoting again, "A pressure not previously experienced by the water supply industry." Are you acknowledging there that cost pressures in the past few years are more dramatic than the water industry was experiencing in years prior thereto?

A Yes. I think that the combination of factors has presented the industry with really a new challenge. And I guess I would attribute a lot of the cost pressure these days to infrastructure problems. It's simply the aging, nature of many utilities that is bringing home the cost of delivering water.

Q Would you agree that a responsible utility cannot ignore any of these three factors that you've described so as to reduce costs?

A Yes.

Q Would you agree that customer growth, either internal growth or growth by acquisition and consultation, that it may be one means for a utility to reduce the impact of these rising costs because you can spread your fixed costs over a larger customer base?

A To the extent that you can achieve economies of scale on the cost side, expansion of the customer base is desirable.

An important consideration also is that per capita water demand is relatively stable. So absent adding new customers, utilities are faced with the unhappy situation of rising costs and fairly stable demand profile.

So I would, I guess, agree with the idea that growth in the number of customers to support the cost of the system is generally desirable.

Q Thank you, Doctor. And I will get into just a second the per capita consumption being relatively stable that you discussed.

Could I ask, Dr. Beecher, if we could have a late-filed deposition exhibit, and that would be your article "Liability Policies and Assessment Methods for Small Water Utilities" dated June 1992. I'd like to ask that that be presented as an exhibit in this case. The entire article.

CHAIRMAN CLARK: I'm sorry. Do you have copies of it?

MR. ARMSTRONG: No. That's the problem. That's what I was hoping -- oh, wait. Actually this is it. This, what I was just given a copy of, Madam Chair. I haven't been able to look through the whole thing I was hoping to get into exhibits.

CHAIRMAN CLARK: Is that the exhibit or the document that Mr. Twomey cross examined her on?

MR. ARMSTRONG: Extensively, yes, Madam Chair.

CHAIRMAN CLARK: And I guess it was

Mr. Twomey's intention to have that identified as an exhibit. Give me the title of that again.

MR. ARMSTRONG: "Viability Policies and Assessment Methods for Small Water Utilities.' Dated June, 1992.

CHAIRMAN CLARK: Was that the document you asked questions from?

MR. TWOMEY: Yes, ma'am. I'd be happy for them, you know, to have the whole thing.

CHAIRMAN CLARK: We'll go ahead at this point and identify it as Late-filed Exhibit 134. Viability Policies and --

MR. ARMSTRONG: Viability Policies and Assessment Methods.

CHAIRMAN CLARK: And the date?

MR. ARMSTRONG: June 1992.

COMMISSIONER KIESLING: Could I just ask a clarifying question. Who is it you're expecting to furnish this?

MR. ARMSTRONG: We can furnish it.

COMMISSIONER KIESLING: Okay.

MR. ARMSTRONG: As long as we can get it in. We'll furnish it.

COMMISSIONER KIESLING: Okay. I didn't know if you were asking the witness, since you asked for a late-filed exhibit.

MR. ARMSTRONG: We'll do this. Do this today and get copies made.

CHAIRMAN CLARK: I'll still title it as late-filed at this point, if we do get the copies, we will go through the process of admitting it in the record at that time.

MR. ARMSTRONG: Okay. Thank you.

(Late-Filed Exhibit No. 134 identified.)

Q (By Mr. Armstrong) In fact, Dr. Beecher, I believe I read somewhere during your deposition when the discussion of growth was occurring, that you had mentioned and possibly quoted that article where you said growth is essential to success of the utility?

A Yes. Based on our analogy of water utilities to other businesses, we made a generalization in that report that growth is a key factor to long-term financial health.

Q Given that fact, and only based on your experience in your opinion, would a regulator properly be able to consider this beneficial impact from fostering growth as a policy consideration when determining an appropriate rate structure?

A I think growth has to be considered very carefully. I think one of the reasons we have so many small water systems is because we didn't practice good growth management practices. And also as our sources of water supply continue to be stressed, I think it's very important to proceed with growth in a very careful way. But in the narrow world of public utility rate setting, if we can spread high costs over a larger customer base that should be advantageous for the customers.

Q Okay. Thank you.

Would another way of saying that be -- obviously that we have all of these certificated utilities in the state of Florida that you've already discussed. Would it be advantageous for future development, future developers to receive some sort of encouragement to come into those areas where utility service is already available to do that development as opposed to going out to rural areas where there's no such infrastructure?

A I would agree with that.

Q A little bit earlier you mentioned that there might be some per capita consumption levelization or stabilization. And I know that was based on your general experience. Are you aware of that in Florida, we have what is undeniably a need for water conservation in this state?

A Yes, that is my understanding.

Q Could I just ask you, I guess, to assume here, a utility such as Southern States that operates 100 water facilities across the state of Florida, we file a rate application with the Commission; given the need for water conservation in Florida, would you agree that that need for water conservation is a factor which should be considered by the Commission when determining a rate structure in this case?

A I believe the economic efficiency of the price signal should be a consideration for the Commission. And to the extent that water is properly priced, it will encourage the appropriate level of conservation.

In addition, if there are larger conservation concerns or issues, the price determination can also be made in the context of other programs and policies.

Q Thank you. You've lead me to my next question. And I'm going to ask you to assume that in reviewing the facts and information prensented in this case, let's assume hundred service areas represented, hundred water service areas. And through the analysis of that information we determine -- the Commission determines that 15 of those areas are using twice as much water as the remaining 85 service areas; the customers in the remaining 85 service areas. Would you agree that that fact may be cause for additional consideration of establishing a rate structure for this utility?

A I believe it's appropriate for the Commission to consider the conservation issues associated with the rate structure. But the Commission's consideration of that does not divest the Utility of its responsibility to be a good steward of our water resources, and that may include working with those communities very proactively to help them find ways to conserve water and reduce their water bill.

Q So that would include customer education efforts?

A Yes.

Q Other customer efforts at conservation like retrofit devices and that kind of thing?

A Yes.

Q And you're familiar with those programs, that they exist?

A Yes. And, of course, I'm assuming that implementation of those programs would be cost effective and prudent.

Q Right. Thank you.

Q Okay. I ask you to further assume that those 15 service areas which are consuming twice as much water as the remaining 85, I would like you to assume that those happen to be the 15 service areas that would otherwise be called subsidizers -- and I don't like the word, but for ease of reference, those are the 15 areas that would be subsidizers if the uniform rate structure was implemented.

Do you believe that that fact is appropriate for consideration by the Commission when determining the conservation impact of a uniform rate structure?

A Yes. I think the Commission would appropriately consider the usage patterns of those populations coupled with the rate impact on them.

Q Thank you. I know this also was addressed in your deposition. But through your discussions with Staff of the commissions throughout the country regarding your survey, it's true to state that the majority of the systems which were under uniform rate structure were not physically interconnected, correct?

A That's correct. My understanding in conducting the survey and in the conversations, the follow-up conversations I had with Staff members, was that our survey picked up, for the most part, noninterconnected systems.

Q Thank you. Just to try to get this succinctly into the record, an attempt to, you would agree in a state where there has been a proliferation of smaller sized utilities the ability to charge a uniform rate may encourage the consolidation of smaller utilities into a larger utility; is that correct?

A Yes, I believe that's correct.

Q I hope you don't mind this question, but I was wondering if you could identify the benefits you could see from that consolidation to a larger utility?

A We have a large number of water utilities in this country, a large number of water systems. And on the face of it, it appears to be too many, especially since we know that approximately 85% to 95% of the systems serve maybe 10% of our population nationally. The other systems are quite large and are serving most of our citizens.

So on the face of it, we may not be achieving the kinds of economies of scale that we could achieve for our customers. And in the context of rising costs it certainly would be to our advantage to find ways to achieve those economies of scale and provide service in the best way possible.

Did I answer your question?

Q Well, I think that you told us why it would benefit, the consolidation would benefit everyone.

In that benefit, you see that benefit being to the utility, as well as to the customers, as well as to the state; is that correct?

A I think we ask our water utilities to do a lot to provide us safe, adequate, reliable service. And we'll want them to do that at an affordable price, because water is a invaluable resource in many respects. And through consolidation, I think we may be able to achieve some of those public policy goals effectively.

This is not to say that consolidation is necessary or warranted in every case, and it is not to say that it doesn't raise implementation issues. For example, larger consolidated systems may cross jurisdictional boundaries in terms of communities and even states.

Say, for example, if we organized water systems across water sheds. So it is presenting us with new issues in terms of finding ways for people to participate in the decision-making for their water system.

So we have new challenges that come with consolidation, as well. But I think there are economic benefits that could potentially be achieved and I think we're starting to see those appear in some areas.

Q Thank you. I appreciate the fact you mention that these are new challenges. These really are challenges of recent vintage, are they not?

A I believe they are. Because water has been structured so much at the local level and predominantly as a publicly-owned utility operation, despite the presence of a substantial investor-owned industry. So yes, I think we are being challenged by this and we will need to be diligent; and that includes our regulatory commissioners, but also policy makers at all levels.

Q Again I will just test the knowledge that you have of other industries. But as I look at the electric industry, it is my understanding the history of the electric industry is that we had a similar situation years ago that we face in the water industry now. There were many, many electric providers out there; but through a process of consolidation, we now see only eight in the state of Florida, I believe it is?

MR. TWOMEY: I object, Madam Chair. Mr. Armstrong is testifying.

CHAIRMAN CLARK: Mr. Armstrong?

MR. ARMSTRONG: My question comes now, if I could ask the question.

CHAIRMAN CLARK: Would you rephrase your question, please.

MR. ARMSTRONG: Yeah. I didn't state the question yet. I was going to state it now.

Okay, I got you now.

Q (By Mr. Armstrong) Dr. Beecher, will you agree that what the water industry is facing now is akin to what has occurred already in, say, the electric industry?

A I think there are similarities. But I think there are some fundamental differences. The technology of delivering electricity is so different, it is so much easier to move electrical power over distances and it is so much easier to interconnect systems at a reasonable cost.

So I do think there are similarities but I also think that we will probably never pattern the water industry in quite the same way. For one thing, water has natural boundaries; and generally we like to respect Mother Nature's boundaries to some extent and not move water, for example, from one aquifer or one watershed to another. That will be a constraint.

And water is a natural resource. It is also a utility product that we consume physically. So some of those characteristics -- and there's a whole bunch of others -- would make it somewhat different from the electric industry.

Q I guess there's one similarity that Southern States has been open about. We believe that uniform rates for our Company the way we operate is akin to the uniform rates for the electric and telephone industry.

I reviewed the deposition and understand you heard the one instance that Southern Bell has 12 or 13 residential classifications for their service. Could you just tell us whether you agree with Southern States that uniform rates in the other industries, the way we're progressing now, that it's akin to what we are requesting -- and it is our belief that the one telephone exception is the exception that is attempting to swallow the rule. Do you agree with our point of view?

A I think the Commission has to look at the breadth of evidence in this case and make that determination. I cannot say that I would advocate or oppose your point of view on this particular issue. And again, the analogy to other industries and whether the Commission can draw experience and insight from those other industries will be up to the Commission.

Q Thank you.

Would you agree that public health and safety concerns should be a factor in determining whether utility consolidation is to be encouraged?

A I think it has been and I think it should be considered.

Q Would you also agree that environmental protection considerations should be a factor in determining whether utility consolidation is to be encouraged?

A I think it has been and I think it should be.

Q So would you then agree that providing uniform rates to a utility which has consolidated many small utilities into one utility operation could be a means of protecting the public health and protecting the environment?

A I think that's a bit of a leap. I think, again, we have to separate out the economies of scale that come on the cost side versus consolidation on the rate side, because they are separate issues.

To the extent that a uniform or single tariff pricing mechanism enhances the financial viability of the utility and promotes high quality, least-cost service on the part of that utility as a whole, then I could see that those would be compatible goals.

Q Thank you.

At Page 11, I believe its Line 17 of your testimony, you refer to the shift to nonsubsidized selfsustaining operations and in parenthetical you state, "especially for publicly owned systems." There, I think there was some discussion about that earlier; you were referring to the government subsidies of water service rates through other tax revenues, that kind of thing?

A That could include tax revenues but also grants.

Q Grant, okay. You would agree that when a developer artificially keeps rates low to, as Mr. Twomey indicated, to foster development in his area, that would be another type of subsidy; is that correct?

A It depends on whether or not the --

COMMISSIONER GARCIA: Excuse me, could you ask the question again? I missed it.

MR. ARMSTRONG: Sure. I asked if Dr. Beecher would agree that another type of subsidy would be when a developer artificially keeps the water rates low as one consideration for a home buyer about whether they're going to buy in his development.

A I think that would depend in part on whether the cost of connecting to the water systems is ultimately paid by the customer through the cost of the home. So it's hard to characterize it as a subsidy if connection and development charges or contributions are factored in and reflect the cost of service. So whether or not it is a subsidy depends on whether it reflects the cost of service or not, when those costs are paid up front.

COMMISSIONER GARCIA: Are you addressing there what would be a service availability charge within that?

WITNESS BEECHER: I guess I was thinking more in terms of contributions or system development charges. But I guess at times there are cost availability charges as well. I mean, there's different terminology used --

COMMISSIONER GARCIA: Right.

WITNESS BEECHER: -- but an upfront capital payment I guess is what we are talking about.

COMMISSIONER GARCIA: And would you consider the service availability charge a way to address those *contribution needs?*

WITNESS BEECHER: I'm sorry, was that a question?

COMMISSIONER GARCIA: Yeah, forgive the formulation of it. Would you consider it service availability charges part of -- and I may be pulling away a little bit from where the question was leading, but just for my own curiosity. Would you consider service availability charges part of the incentive that the developer may or may not have in building out the system? Or the advantages that a developer may or may not have to pay some of those costs and the costs of providing water?

WITNESS BEECHER: I guess I would. To the extent that there is a price arrived at between the utility and the developer, it will provide incentives or disincentives, I suppose.

Q (By Mr. Armstrong) So in that regard, if a utility is authorized to charge a competitive service availability charge to that developer -- and by "competitive," I mean it's competitive with the utilities that surround it or the neighborhood where the developer otherwise might develop -- with that competitive service availability charge, would that help to foster growth of that utility?

A Yes. If it is comparatively cheaper, all other things being equal, it would seem to me an attractive alternative for the developer to connect in a lower cost way.

COMMISSIONER GARCIA: Since your testimony is in a broader scale, let me ask you that, because we have been addressing other issues.

If a service availability charge is too low or lower than the prevailing charges by a county for impact fees from its local system or a city by its hookup fees for its local system -- and I use the word "impact fees." Some cities call it one thing, others call it others, like you said.

Would that be a disincentive or would that -- I guess a "disincentive" would be the right word for that local system and for that and/or local county -- let me go back. For that local government, whether it be a city or a county or even perhaps another water company which may have higher service availability charges, would that lower service availability charge by a company in an area where there are higher charges have a negative effect on those companies' ability to meet the environmental requirements, growth requirements, infrastructure requirements that they may have?

If you want to, I know my question is a little bit convoluted, if you want, putting it in a simpler term: If we have a company which is providing service availability, and let's just make up a number, at $750, and all the companies around it, or all the companies and/or governments around it are providing it at $3,000, would that lower service availability charge not be a hindrance to those local companies or governments in their efforts for growth or to meet infrastructure demands -- or environmental demands, I guess. Because if they had such a high service availability charge, I guess it would be based on many of those considerations.

WITNESS BEECHER: If I could answer this with a bit of a back drop?

COMMISSIONER GARCIA: Absolutely.

WITNESS BEECHER: One of the projects I worked on quite a bit during the last year was a national survey of water, wastewater and stormwater rates. And we asked about these charges, called them system development charges or other service extension charges.

And it was striking to me that I really don't identify, I think, any investor-owned water utilities that really used these. And in addition, the connection fees to our investor-owns tended to be smaller than for municipally-owned systems. So we do see a difference.

COMMISSIONER GARCIA: I'm sorry, go back, I just missed it.

WITNESS BEECHER: For our investor-owned systems they seemed to use little or no connection or system development -- connection fees to already existing --

COMMISSIONER GARCIA: As opposed to?

WITNESS BEECHER: As opposed to cities who will tend to charge more. This is presenting an interesting policy question for us -- although we have a lot of these issues in water because we have different practices and policies going on depending on ownership.

I did ask some of our investor-owns, "Well, why don't you have these charges?" And their answer was they would like to add customers and that would help them spread costs, extend service, build their business. They're operating a business.

So it seems, at least on the face of it, that our municipal utilities are using development charges, or whatever we call them, to manage growth, build some upfront capital for growth. So it's a bit of a growth management strategy; and I think it's driven partly because of the incentives of cities to control growth one way or the other. Some cities want to grow, some cities definitely don't want to grow, so they appear to be using it as a growth management tool.

It's a bit like comparing apples and oranges. But the bottom line, I think, is --

COMMISSIONER GARCIA: I'm sorry, comparing counties or governments to private companies?

WITNESS BEECHER: To investor-owned utilities, exactly. And we're talking about how those entities combine these upfront fees with ongoing rates for service. And that raises questions of intergenerational equity and how we spread cost over time, and I think it's a very difficult issue to evaluate.

But your question, if I do remember it, about whether the lower cost --

COMMISSIONER GARCIA: It doesn't matter, you have educated me in the process.

WITNESS BEECHER: -- whether the lower cost alternative provides an incentive to a developer, it would seem fairly clear that, all other things being equal, the developer should probably want to extend, you know, the development into an area served at a lower initial cost. Particularly given the pattern of investment that we've seen.

COMMISSIONER GARCIA: And wouldn't it also, if we follow that thinking, also provide a lower service availability charge? Wouldn't it also provide a great incentive or I guess an incentive -- it does, obviously, we've already stated it provides an incentive for the water company, the service availability, because it gets more customers and its in the business of doing that.

But likewise, if the rates of the customers are covering all of the capital expenses and the service availability charge has nothing to do with those capital expenses, it clearly is to the developer's advantage to lower that rate as much as possible so that it gets more customers?

WITNESS BEECHER: I would think so.

COMMISSIONER GARCIA: And obviously it doesn't have any impact on its overall revenues.

WITNESS BEECHER: On the developer's revenues?

COMMISSIONER GARCIA: Correct.

WITNESS BEECHER: That would seem apparent to me, but I'm not an expert --

COMMISSIONER GARCIA: Or on the water company's revenue --

WITNESS BEECHER: Right, right.

COMMISSIONER GARCIA: -- because it continues to grow. Thank you.

COMMISSIONER JOHNSON: Let me ask you a question on some of the background information you gave Commissioner Garcia before answering the question.

You said that with respect to municipalities you believe that they use the service availability charge as a mechanism of controlling the growth in the county or in the city? Was that one of your findings?

WITNESS BEECHER: I think, while we can't maybe demonstrate that real systematically, it appears that especially in areas experiencing water shortages, the cost of hooking up to systems say in California might be much higher than say in the Midwest where the incremental cost of water is relatively low.

COMMISSIONER JOHNSON: But that went to cost, not to -- what you just explained to me seemed more to go to the actual cost as opposed to a method of controlling the growth of the area.

WITNESS BEECHER: I think it's a combination. I mean, I think it's growth but at a level that can be supported economically. So, in other words, rather than maybe spreading those costs in another way, there's that upfront capital payment to account for the additional capacity needed by that water utility.

COMMISSIONER JOHNSON: And I don't know if you have discovered this, this is somewhat of an aside. But to the extent that the local entity or the municipal entity, say it was a county, that they were using the service availability charge as a means of controlling growth but they have a privately-owned utility within their county, that would kind of mess up their growth management plans, would it not, because they wouldn't be able to control the growth for those sectors of that particular county?

WITNESS BEECHER: That's correct. And I would not -- I should, I should add that when I talk about controlling growth, I'm not necessarily implying that the utility, even a municipal utility, can control its growth simply through the water rate. I mean, it's obviously part of an entire strategy. But the difference between a public utility that has local growth management policies under its purview as opposed to an investor-owned, which is an investor-owned and apart from the local government, there is that disparity, yes.

COMMISSIONER JOHNSON: Thank you.

COMMISSIONER GARCIA: Mr. Armstrong, if you will forgive me a little longer?

MR. ARMSTRONG: Certainly.

COMMISSIONER GARCIA: Following that, and I know your testimony is not along these lines but perhaps you could venture through your expertise maybe a suggestion.

What do you find that service availability charges are usually based on? If you don't know, you can answer you don't know. Or give me a few theories, if you have them.

WITNESS BEECHER: I'll offer a few theories but I will say this is not something I have studied in depth.

It appears to me you are going to find every range. You are going to find availability charges based on a fairly extensive cost of service analysis. You are also going to find availability charges that are probably pretty arbitrary. We see something similar in, for example, inside/outside pricing. Sometimes they just pick 50% because that's a simple number.

I think there's been a heightened awareness of the role of these charges in paying for water service and what kind of price signal those charges themselves send. We're working on a rate manual now where for the first time we're thinking about the price signal of an availability charge. We think a lot about the price signal of the ongoing rates; but those send a signal, too.

I think it's a relatively new area. The statutory authority has evolved, as I understand it, pretty significantly just in the last few years in terms of the ability of the utilities to even use that. And that will probably vary quite a bit from state to state.

COMMISSIONER GARCIA: Thank you, Doctor. And I'm sorry, Mr. Armstrong, to --

MR. ARMSTRONG: That's okay. I guess I'll trying to get to the meat now in terms of this case.

Q (By Mr. Armstrong) Southern States has requested a uniform rate, as you're aware, and we've also requested a uniform service availability charge, uniform for water conventional treatment, uniform for our reverse osmosis water treatment, and then a uniform wastewater charge.

We have based that on a study that we did, a survey of 300-some-odd utilities and their charges, their service availability charges, county, city, not-for-profit, as well as investor-owned statewide, because we operate statewide.

Do you have an opinion whether or not that's a reasonable method of setting a service availability charge for the Commission for the Company to be given a charge which is competitive with our competitors but is a uniform charge across the state?

A I really can't comment on that.

Q Okay, thank you.

One thing you did get into in prior cross examination this morning was the concept of common costs. And you're familiar with the fact if you have multiple facilities that one utility serves there will be common costs, correct?

A That's correct.

Q Obviously, a significant question in the case is the stand-alone cost of service versus the utility-wide cost of service.

If you would assume that Southern States' common costs represent approximately 40% of our revenue requirement, you would agree that what has been called a stand-alone cost of service for any particular service area would differ depending on what method the Commission chose to allocate those costs among those service areas, wouldn't you?

A That would be correct.

Q And the methods could be labor, consumption -- any number of methods to allocate those costs, correct?

A Yes.

Q In addition, there are some common costs in terms of the cost of capital in this case. You would agree also that there are different methods of allocating those costs, would you not?

A Yes.

Q And what has been called the stand-alone cost of service, that also would differ based upon which method of allocating those costs were chosen, correct?

A Yes.

Q Thank you.

I believe at Page 13, Lines 1 through 3 of your testimony, if I could quickly just read that. It says, "If a customer base cannot support the cost of water service, potential lenders may be concerned about the utility's financial viability and ability to meet debt obligations." If lenders have that concern the likely result would be higher debt cost to the utility; is that correct?

A That would be my understanding, yes.
Q As a matter of fact, if the lenders are very concerned they may not even be willing to lend that utility any money; isn't that correct?
A Yes. And I think that has been a concern for small systems.
Q As a matter of fact, if small systems can't get access to those funds, they might become what we call nonviable, correct?
A Correct.
Q At a minimum, if the lenders increase the cost of capital to the utility, what we're going to see is an increase in the cost of service of the utility, correct?
A That's correct.
Q Which then would translate to increased rates to the customers; is that correct?
A Correct.
Q Thank you.
Do you also have an opinion as to whether or not a lender would be affected in his decision whether to lend money to the utility depending on whether or not that utility has rates set by the regulator which are sufficient to recover his cost of service?
A I think lenders do care about that, from the

World Bank on down.

Q Would you have an opinion as to whether a lender would look favorably upon a uniform rate for a utility such as Southern States which has diversified facilities throughout the state, and a number of them?

MR. TWOMEY: Madam Chairman, I object on that to the extent that, well, certainly broad latitude has been permitted here in terms of rate structure issues and so forth in her publications. I don't believe that either her direct testimony or any of the publications cited to by myself or Mr. Armstrong go into the notion of lender criterion. I think it's beyond the scope of her direct or my cross of her.

CHAIRMAN CLARK: Mr. Armstrong?

MR. ARMSTRONG: Madam Chair, I just referred directly to one portion of a couple where Dr. Beecher refers to the cost of water service and the fact that potential lenders may be concerned about the utility's financial viability and the ability to meet debt obligations.

CHAIRMAN CLARK: I'll allow the question.

MR. ARMSTRONG: Thank you Madam Chair.

Q (By Mr. Armstrong) My question stands, if you know, Dr. Beecher.

A I believe that potential lenders would consider the rate structure. Whether or not they would favor a single tariff pricing mechanism or a uniform rate over other mechanisms, though, can't be speculated upon.

MR. ARMSTRONG: Okay.

CHAIRMAN CLARK: Mr. Armstrong, are you almost done?

MR. ARMSTRONG: No, I probably have probably 15 or 20 minutes more. We could break if you would like to break. I might be able to go through and cut some of this, actually, if I get a chance to.

CHAIRMAN CLARK: All right. We'll take a break until 1:15.

MR. ARMSTRONG: Thank you.

(Thereupon, lunch recess was taken at 12:30 p.m.)

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(Transcript continues in sequence in Volume 16.)

Center for Urban Policy and the Environment
School of Public and Environmental Affairs
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PROFESSIONAL EXPERIENCE

Senior Research Scientist and Director of Regulatory Studies. Center for Urban Policy and the Environment, School of Public and Environmental Affairs, Indiana University. Indianapolis, Indiana. April 1995 to Present. Principal investigator and analyst for regulatory and environmental research and director of the regulatory studies program focusing on research related to the structure and regulation of the water utility regulation. Responsible for the program's research agenda, funding and development, and clearinghouse functions. Serve as liaison to federal and state regulators and policymakers, professional associations, university faculty, and others interested in water utility and regulatory issues.

Adjunct Professor. School of Public and Environmental Affairs, Indiana University, Indianapolis. August 1995 to present. Teach graduate and undergraduate courses in public policy. Special adjunct faculty appointments at The Ohio State University and Southern Illinois University for graduate student committees.

Senior Institute Research Specialist. The National Regulatory Research Institute, The Ohio State University. Columbus, Ohio. November 1988 to Present. Principal project manager and regulatory analyst for water utility research; assisted in setting the research agenda, funding and grant development, and external relations; member of the staff subcommittee of the National Association of Regulatory Utility Commissioners (NARUC) Water Committee; liaison to state commissioners and staff, federal agencies, university faculty, professional associations, and others interested in water utility and regulatory issues; organizer and moderator for the Water Policy Forum at the Biennial Regulatory Information Conference; and instructor for new commissioner tutorial and other educational programs. Recipient of the 1991 Board of Directors award for excellence; honored by a NARUC resolution in 1995.

Adjunct Associate Professor. School of Public Policy and Management, The Ohio State University. Columbus, Ohio. February 1994 to April 1995. Taught two graduate-level public policy courses, served as a faculty and research advisor to graduate students; sat on graduate student committees; and participated in faculty colloquia.

Policy Advisor to the Chairman. Illinois Commerce Commission. Chicago, Illinois. November 1983 to October 1988. Principal policy analyst, project coordinator, and advisor to the Chairman on matters of administration, legislation, and regulatory policy affecting the electricity, gas, telecommunications, transportation, and water industries; Chairman's liaison to other commissioners, the executive director and division managers, state and federal agencies, the National Association of Regulatory Utility Commissioners, the media, and the general public; author of numerous policy memoranda and speeches.

Associate Investigator. Study of the Precision of Environmental Impact Assessment, funded by the National Science Foundation. Center for Urban Affairs & Policy Research, Northwestern University, 1982 to 1983. Provided project management with primary responsibility for sample selection and coding, planned field research, interviewed knowledgeable informants and collected data, assisted in data management and statistical analysis, conducted investigation of policy implementation and nonimplementation, and coauthored final report.

Research Associate. Governmental Responses to Crime Project, funded by the National Institute of Justice. Center for Urban Affairs & Policy Research, Northwestern University, 1980 to 1982. Completed a study of political responses to crime in American cities using interviews with knowledgeable informants and other sources, provided data management, and coauthored final report.

Research Associate. Wind Energy Research Project, funded by the Solar Energy Research Institute. Center for Urban Affairs & Policy Research, Northwestern University, 1980. Designed and conducted field research and coauthored final research report.

Research Associate. Illinois Sunset Review Project, funded by the Illinois General Assembly. Department of Political Science, University of Illinois at Chicago, 1980. Researched federal impacts on state licensure and coauthored final report to the Illinois legislature.

Teaching Assistant. Department of Political Science, Northwestern University, 1980. Aided instructors for American presidency and law and politics courses, assisted undergraduate students, and graded papers and examinations.

Banking. Elmhurst Federal Savings and Loan and Elmhurst National Bank, Elmhurst, Illinois. 1974 to 1979.

EDUCATION

Ph.D. Northwestern University, August 1986. Political Science.
Major: Public Policy. Minors: Political Behavior & Institutions, Law & Politics, and Urban Politics.
Dissertation: *Uncertain by Design: A Structural Theory of Regulation by the State Public Utility Commissions.*

M.A. Northwestern University, August 1980. Political Science.
M.A. Thesis: *When Governments Intervene: The Adoption of Regulatory Policy in the American States.*

B.A. Elmhurst College, June 1979. Economics, Political Science, and History.
Phi Kappa Phi (the college's ranking scholastic honors society). Graduated with highest honors.

Scholarships
Northwestern University Scholarship, 1982-1983.
Northwestern University, Center for Urban Affairs & Policy Research Fellowship, 1981-1982 and 1980-1981.
Northwestern University Fellowship, 1979-1980.
Elmhurst College Freshman Scholar, 1977-1978.

PAPERS AND PUBLICATIONS

Books, Monographs, and Reports

Janice A. Beecher. *1995 Inventory of Commission-Regulated Water and Wastewater Utilities.* Indianapolis: Center for Urban Policy and the Environment, 1995.

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Paul J. Culhane, H. Paul Friesema, and Janice A. Beecher. *Forecasts and Environmental Decisionmaking: The Content and Predictive Accuracy of Environmental Impact Statements.* Boulder, CO: Westview Press, 1987.

Paul J. Culhane, H. Paul Friesema, and Janice A. Beecher. "The Precision of Environmental Impact Assessment: Implementation Status and Sample Selection." CUAPR Working Paper Series. Evanston, IL: Center for Urban Affairs & Policy Research, September 1982.

H. Paul Friesema, Janice A. Beecher, and Cleveland Fraser. *Blowing in the Wind: The Prospects of Utility Adoption of Wind Energy Systems.* Report to the Solar Energy Institute. Indianapolis, IN: The Institute of Ecology, 1980.

Articles, Chapters, and Proceedings

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Janice A. Beecher, Robert L. Lineberry, and Michael J. Rich. "The Politics of Police Responses to Urban Crime." In Dan A. Lewis, ed., *Reactions to Crime.* Beverly Hills: Sage, 1981.

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Janice A. Beecher. "Federal Impacts on State Occupational Licensure." In Charles Williams, et al., *Illinois Sunset Review Project: Final Report.* Chicago: University of Illinois, 1980.

Papers and Presentations

Janice A. Beecher. "Global Aspects of Water Utility Privatization and Regulation," at a conference of the Institute for Global Climate Change, Indiana University, Bloomington (March 1996, paper accepted).

Janice A. Beecher. Panel participant on "Musings on the Post-ULV Era," at the *Conserv96* conference in Orlando (January 1996).

Janice A. Beecher. Panel participant on "Environmental Public-Private Partnerships--Setting the Tone for the Future," at the Annual Conference of the National Council for Public-Private Partnerships in Chicago, Illinois (October 1995).

Janice A. Beecher. "Regulatory Implications of Water and Wastewater Utility Privatization." A presentation to the Illinois Commerce Commission in Springfield, Illinois (October 1995).

Janice A. Beecher. "Structure and Regulation of the Water Utility Industry: Changes and Challenges." A presentation at the Utilities Conference of the Indiana CPA Society (October 1995).

Janice A. Beecher. Panel participant in the *Water Policy Forum* of the National Association of Water Companies in Naples, Florida (September 1995).

Janice A. Beecher. "Water Demand, Prices, and Revenues: The Effects of Conservation." Presentation at the Annual Conference of the American Water Works Association in Anaheim, California (June 1995).

Janice A. Beecher. Moderator for "Reauthorization of the Safe Drinking Water Act" at the Annual Meeting of the Mid-America Regulatory Conference in Indianapolis, Indiana (June 1995).

Janice A. Beecher. "Emerging Issues in Benchmarking and Performance-Based Water Utility Regulation." Presentation at the Annual Meeting of the New England Chapter of the National Association of Water Companies in Kennebunkport, Maine (May 1995).

Janice A. Beecher. "Regulatory Implications of Water Utility Privatization: Research Findings." Presentation at the Water Committee Seminar of the Winter Meeting of the National Association of Regulatory Utility Commissioners in Washington, D.C. (February 1995).

Janice A. Beecher. "The Water Industry: Coordinating Regulatory Functions and Resource Planning." Presentation to the Select Committee on Water Policy of the Florida House of Representatives in Tallahassee, Florida (February 1995).

Janice A. Beecher. "Emerging Regulatory Requirements for Conservation and IRP." Presentation at the American Water Works Association Water Conservation Workshop in Santa Fe, New Mexico (January 1995).

Janice A. Beecher. "Managing Watersheds for the Twenty-First Century: An Integrated Planning Perspective." Panelist at the Wayne Nichols Program, School of Natural Resources, The Ohio State University (November 1994).

Janice A. Beecher. "Impacts of Legislative Regulations." Panelist at the Annual Conference of the Water Management Association of Ohio (November 1994).

Janice A. Beecher. "Integrated Approaches to Resource Planning and Environmental Protection." Organizer and moderator at the Public Policy Roundtable on Business and the Environment, School of Public Policy, The Ohio State University (October 1994).

Janice A. Beecher. "Regulatory Excellence for the 21st Century." Presentation at the Annual Meeting of the National Association of Water Companies in Scottsdale, Arizona (October 1994).

Janice A. Beecher. "Financial Distress Assessment Models for Small Water Utilities." Presentation at the Annual Conference of the American Water Works Association in New York (June 1994).

Janice A. Beecher. "Decision Analysis for Integrated Resource Planning." Moderating panelist at the Annual Conference of the American Water Works Association in New York (June 1994).

Janice A. Beecher. "General Summary of the NRRI State Commission Survey on Water Conservation Pricing and Revenue Recovery Issues." Presentation to the Committee on Rates and Charges at the Annual Conference of the American Water Works Association in New York (June 1994).

Janice A. Beecher. "Economic Regulation of Water Utilities in the United States." Presentation to a delegation from Argentina (ETOSS) in Washington, D.C. (April 1994).

Janice A. Beecher. "Economic Regulation of Water Utilities in the United States." Presentation at the World Bank, Workshop on Institutional Options for Price Regulation of Water Utilities (April 1994).

Janice A. Beecher. "Water Utilities and the Environment." Presentation at the Annual Technical Conference of the National Association of Regulatory Utility Commissioners in Washington, D.C. (February 1994).

Janice A. Beecher. "Incentive Regulation for Water Utilities." Presentation at the Water Committee Seminar at the Winter Meeting of National Association of Regulatory Utility Commissioners in Washington, D.C. (February 1994).

Janice A. Beecher. "Integrated Resource Planning for Water Utilities." Presentation at Conserv93 in Las Vegas, Nevada (December 1993).

Janice A. Beecher. "The Role of the State Public Utility Commissions in Water Conservation." Moderator for an affinity group at Conserv93 in Las Vegas, Nevada (December 1993).

Janice A. Beecher. "Institutional Roles and Responsibilities for Integrated Water Resource Planning: Discussion Paper." Paper prepared for the Water Industry Technical Action Fund (WITAF) and presented at the Annual Conference of the American Water Works Association in San Antonio, Texas (June 1993).

Janice A. Beecher. "Consensus Building for Integrated Water Resource Planning: Discussion Paper." Paper presented at the Annual Conference of the American Water Works Association in San Antonio, Texas (June 1993).

Janice A. Beecher. "Integrated Water Resource Planning: Discussion Paper." Paper prepared for the Water Industry Technical Action Fund (February 1993).

Janice A. Beecher. Panel presentation on Water Utility Regulatory Issues at the New England Chapter of the National Association of Water Companies in Plymouth, Massachusetts (June 1992).

Janice A. Beecher. "Economic and Regulatory Impacts of the Safe Drinking Water Act." Paper presented at the New England Conference of Public Utility Commissioners (May 1992).

Janice A. Beecher. "Contemporary Water Issues." Presentation to the Energy and Public Utilities Committee of the Connecticut General Assembly in Hartford, Connecticut (January 1992).

Janice A. Beecher. "Small Systems Solutions." Presentation at the Annual Meeting of the National Association of Water Companies in St. Louis, Missouri (October 1990).

Patrick C. Mann and Janice A. Beecher. "The Cost and Rate Impact of the Safe Drinking Water Act." Paper presented at the Iowa State Regulatory Conference in Ames, Iowa (May 1990).

Janice A. Beecher. "Economics of Future Water Supplies." Presentation at the Conference on Water Sufficiency for the 21st Century Sponsored by the International Center for Water Resources Management, Central State University in Wilberforce, Ohio (May 1990).

Janice A. Beecher. "State Regulatory Issues in the Age of Discovery." Presentation at the American Water System Annual Management Seminar. Columbus, Ohio (May 1989).

Janice A. Beecher. "Value, Cost, and Price: Essay on Emerging Water Utility Issues." Paper presented at the Symposium on International and Transboundary Water Resources Issues in Toronto, Ontario (April 1990).

Janice A. Beecher. "State Public Utility Commissions and State Drinking Water Administrators: A Case for Interagency Coordination." Presentation at the Environmental Protection Agency's Workshop on Financing Strong State Water Programs in Denver, Colorado (April 1989).

Janice A. Beecher. "Applying Political Science." Panelist on the Applied Political Science Panel, Annual Meeting of the American Political Science Association, Chicago, Illinois (September 1987).

H. Paul Friesema with Janice A. Beecher. "The Unclear Connection Between the Scientific Quality of Environmental Impact Statements and Public Policy: Experience in the USA." Paper delivered by H. Paul Friesema at the International Seminar on the Role of Environmental Assessment in the Decisionmaking Process in Heidelberg, Federal Republic of Germany (August 1987).

Janice A. Beecher. "Agricultural Energy Consumption and Conservation in Illinois: An Overview." Research paper prepared for the Illinois Commerce Commission (October 1984).

Janice A. Beecher. "Utility Taxation and Consumer Costs in Illinois: A Statistical Report." Research paper prepared for the Illinois Commerce Commission (May 1984).

Janice A. Beecher, Robert L. Lineberry, and Michael J. Rich. "Crime in the Cities: Politics and Policy Over a Generation." Paper delivered at the Annual Meeting of the Midwest Political Science Association in Cincinnati, Ohio (April 1981).

Instructional Books

Janice A. Beecher. *Study Guide, Instructor's Manual,* and *Test Bank* to accompany Karen O'Connor and Larry Sabato's *American Government: Roots and Reform.* New York: Macmillan, 1993 edition. *Study Guide,* 1995 edition.

Janice A. Beecher. *Test Bank* to accompany *Empty Dreams, Empty Pockets.* New York, Macmillan, 1993.

Janice A. Beecher. *Study Guide* to accompany Robert L. Lineberry's *Government in America.* Boston: Scott, Foresman/Little, Brown, 1983, 1986 and 1989 editions.

Janice A. Beecher, et al. *Instructor's Manual* to accompany Robert L. Lineberry's *Government in America.* Boston: Little, Brown, 1986 edition.

INSTRUCTIONAL EXPERIENCE

Courses

"Introduction to Public Affairs," (Undergraduate, V170). School of Public and Environmental Affairs, Indiana University (IUPUI). Fall 1995.

"Public Policy," (Graduate, V512). School of Public and Environmental Affairs, Indiana University (IUPUI). Fall 1995.

"Public Policy and Program Implementation" (Graduate, PPM 803). School of Public Policy and Management, Ohio State University. Spring 1992 and Winter 1993.

"Public Policy Formulation and Administration" (Graduate, PPM 801). School of Public Policy and Management, Ohio State University. Fall 1991.

Workshops

Regulatory Studies Program for the Louisiana Public Service Commission, Institute of Public Utilities, Michigan State University. Baton Rouge, Louisiana. February 1996. Lead instructor for water utility regulation seminars.

Advanced Regulatory Studies Program, Institute of Public Utilities, Michigan State University. East Lansing, Michigan. January 1996. Lead instructor for water utility regulation seminars.

Regulatory Studies Program, Institute of Public Utilities, Michigan State University. East Lansing, Michigan. August 1994 and August 1995. Lead instructor for water utility regulation seminars.

Workshop on the Structure and Regulation of the Water Industry for the Ohio Consumers' Counsel. Columbus, Ohio. January 1996.

Water Policy Forum, NRRI Biennial Regulatory Information Conference. A series of panels organized and moderated. Columbus, Ohio. September 1992 and September 1994.

SPONSORED RESEARCH

National Regulatory Research Institute. For a descriptive analysis and annotated bibliography on water system regionalization. December 1995.

Raftelis Environmental Consulting Group. For research assistance related to economic regulation and cost allocation. December 1995.

National Association of Water Companies. For a discussion paper on current issues in the structure and regulation of water utilities. July 1995.

Illinois Department of Transportation. For a survey of eastern state law and policy regarding water resource allocation and management. May 1995.

California Urban Water Conservation Council. For participation in the development of a handbook on conservation rates for water utilities. April 1995.

Raftelis Environmental Consulting Group. For a national survey of water, wastewater, and stormwater utility rates. April 1995.

Ohio Environmental Protection Agency. For participation in a study of the use and effectiveness of grants and loans for wastewater treatment. April 1995.

National Association of Regulatory Utility Commissioners For research design and project management in the area of water utility regulation at the National Regulatory Research Institute. November 1988 to April 1995.

Washington Utilities and Transportation Commission. For a study of jurisdictional and regulatory alternatives for water utilities in the state of Washington. March 1994.

American Water Works Research Foundation. For participation in a study of water conservation (subcontractor to principal investigator). April 1993.

Water Industry Technical Action Fund. For a discussion paper on integrated water resource planning. February 1993.

Water Industry Technical Action Fund. For a discussion paper on integrated water resource planning. December 1992.

American Water Works Association. For preparing *Cost Allocation and Rate Design for Water Utilities.* March 1991.

APPOINTMENTS AND PROFESSIONAL ACTIVITIES

Study Group on Identity. Indiana University Purdue University Indianapolis, 1995-1996.

Article Review. *American Water Works Association Journal,* 1995; *Water Resources Planning and Management*, 1995.

Project Review Committee, *Rocky Mountain Institute Study of the Future of Municipal Water Services.* Summer 1995.

Project Advisory Committee, *Small System Regionalization Study.* American Water Works Association Research Foundation, 1994-present.

Liaison from the Conservation Committee to the Management Committee. American Water Works Association. March 1995-present.

Rates and Charges Subcommittee of the Financial Management Committee. American Water Works Association, 1994-present.

Water Conservation Committee. American Water Works Association, 1993-present. Appointed in 1995 as the liaison to the AWWA Management Division.

Columbus Water Conservation Advisory Board. Mayor's appointment, 1994-1995.

Staff Subcommittee of the Water Committee. National Association of Regulatory Utility Commissioners, 1989-1995.

State of Ohio Pollution Prevention Development Workgroup. Governor's appointment, 1993-1994.

Executive Committee. Applied Section, American Political Science Association, 1987-1989.

Research Advisory Committee. The National Regulatory Research Institute, 1987-1988.

Alliance for Least-Cost Energy Planning. City of Chicago, 1987-1988.

EXPERTISE AND PROFESSIONAL SKILLS

Economic and environmental regulation of public utilities.
Structure and regulation of the water supply industry.
Regulatory theory, processes, and decisionmaking.
Institutional, comparative, and intergovernmental policy analysis.
Research design, management, and methods.
Interdisciplinary approaches and analytical frameworks.

REFERENCES PROVIDED ON REQUEST

February 1996

COMMISSION-REGULATED WATER AND WASTEWATER UTILITIES

Utility Ownership	Water Utilities		Wastewater Utilities	
	Number of Commissions	Number of Utilities	Number of Commissions	Number of Utilities
Investor-owned or private	46	4,095	28	1,233
Municipally-owned	11	1,547	6	649
Districts	7	1,300	4	205
Cooperatives	4	1,436	2	50
Homeowners' associations	6	85	1	0
Nonprofits	1	73	1	15
Other	1	1	0	0
Totals	46	8,537	28	2,152

Source: Janice A. Beecher, *1995 Inventory of Commission-Regulated Water and Wastewater Utilities* (Indianapolis, IN: Center for Urban Policy and the Environment, 1995). Includes data for Michigan, which ceased regulating 18 systems in early 1996.

Date: January 10, 1996

To: ______________________________
____
(____) ______________________________

From: Dr. Janice A. Beecher, Director of Regulatory Studies
Center for Urban Policy and the Environment, SPEA, Indiana University
(317) 261-3047 Office, (317) 261-3050 Fax

Re: Quick Survey on Single-Tariff Pricing

Happy New Year! Can you help me by taking a moment to fill out this quick survey and faxing it back as soon as possible? Completing the survey should require only a short amount of time and I will make the results available to everyone.

Single-tariff pricing is used to implement a single rate structure for multiple water (or other) utility systems that are owned and operated by a single utility. With single-tariff pricing, all customers of the utility pay the same rate for service, even though the individual systems providing service may vary in terms of the number of customers served, operating characteristics, and stand-alone costs. Water utilities with multiple systems are not necessarily found in every state.

Please answer the following:

1. Do any of the water **utilities** regulated by your commission have multiple water **systems** (☑)? **Yes** ☐ **No** ☐

   If No, the remaining questions are not applicable to your state. Please return the first page of the questionnaire so that your state will be represented in the survey.

2. If you answered **Yes** to Question 1, please name the multi-system water utilities, the number of systems they operate, and the approximate number of connections for the smallest and largest system operated by the utility. Use an additional sheet if necessary.

Utility Name	*Total Number of Systems*	*Approximate Number of Connections for the:* Smallest System	Largest System

3. Has your commission **approved** single-tariff pricing for any of the utilities named in Question 1 (☑)? **Yes** ☐ *Go to Question 4* **No** ☐ *Go to Question 5*

4. If your answer to Question 3 was **Yes**, please name the utilities and when the tariff was first approved. Use an additional sheet if necessary.

Utility Name	*When was the tariff first approved?*

5. If your answer to Question 3 was **No**, please check all of the following that apply (☑):

☐ Single-tariff pricing has not been an issue.
☐ Single-tariff pricing has been considered but not specifically approved.
☐ A proposal for single-tariff pricing has been rejected.
☐ Other: ______________________________

6. Has single-tariff pricing been explicitly **prohibited** in your state by statute (☑)? Yes ☐ No ☐

When was the statute passed? __________

Please describe the nature of the prohibition: ______________________________

7. Has your commission put any monitoring and/or evaluation systems in place for single-tariff pricing in cases where it has been implemented (☑)? Yes ☐ No ☐

If **Yes**, please describe: ______________________________

8. If your commission **approved** single-tariff pricing, what was the **primary** reason for the approval? ______________________________

9. If your commission **rejected** single-tariff pricing, what was the **primary** reason for the rejection? ______________________________

10. Please characterize your commission's policy position on single-tariff pricing (☑)?
✓
☐ Generally accepted
☐ Generally not accepted
☐ Decided on a case-by-case basis
☐ Never considered

11. If single-tariff pricing has been an issue in your state, whether or not it has been implemented, please review the following arguments in favor and against single-tariff pricing and check all that have influenced your commission's deliberations or policies on the issue. Check (☑) all that apply:

Arguments in Favor of Single-Tariff Pricing

✓

- ☐ Provides incentives for utility regionalization and consolidation
- ☐ Mitigates rate shock to utility customers
- ☐ Promotes universal service for utility customers
- ☐ Promotes ratepayer equity on a regional basis
- ☐ Improves service affordability for customers
- ☐ Addresses small-system viability issues
- ☐ Facilitates compliance with drinking water standards
- ☐ Provides ratemaking treatment that is similar to that for other utilities
- ☐ Lowers administrative costs to the utilities
- ☐ Lowers administrative costs to the commission
- ☐ Promotes regional economic development
- ☐ Encourages further private involvement in the water sector
- ☐ Encourages investment in the water-supply infrastructure
- ☐ Physical interconnection is not considered a prerequisite
- ☐ Overall benefits outweigh overall costs
- ☐ Other: ______________________________

Arguments Against Single-Tariff Pricing

✓

- ☐ Conflicts with cost-of-service principles
- ☐ Undermines economic efficiency
- ☐ Provides subsidies to high-cost customers
- ☐ Distorts price signals to customers
- ☐ Discourages efficient water-use and conservation
- ☐ Encourages growth and development in high-cost areas
- ☐ Encourages overinvestment in infrastructure
- ☐ Fails to account for variations in customer contributions
- ☐ Provides unnecessary incentives to utilities
- ☐ Considered inappropriate without physical interconnection
- ☐ Not acceptable to all affected customers
- ☐ Not acceptable to other agencies or governments
- ☐ Justification has not been adequate in a specific case (or cases)
- ☐ Insufficient statutory or regulatory basis or precedents
- ☐ Overall costs outweigh overall benefits
- ☐ Other: ______________________________

Please provide any additional comments on another sheet. Thank you again for your assistance. I look forward to working with you in 1996.

SUMMARY OF STATE COMMISSION POLICIES ON SINGLE-TARIFF PRICING FOR WATER UTILITIES		
Generally Accepted (8)	Connecticut Missouri North Carolina Oregon	Pennsylvania South Carolina Texas Washington
Case-By-Case (15)	Single-Tariff Pricing Has Been Approved (8) Arizona Florida Idaho (not an issue) Illinois	 New York Ohio Virginia West Virginia
	Single-Tariff Pricing Has Not Been Approved (7) California (partial consolidation) Indiana (rejected) Maryland (not an issue) Massachusetts (partial consolidation; case pending) Mississippi (not an issue) New Hampshire (partial consolidation) New Jersey (case pending)	
Generally Not Accepted (1)	Vermont (rejected)	
Never Considered (5)	Iowa Kentucky Louisiana	Maine Wisconsin
Not Applicable (16)	Alabama Alaska Arkansas Colorado Delaware Hawaii Kansas Montana	Nebraska Nevada New Mexico Oklahoma Rhode Island Tennessee Utah Wyoming
No Jurisdiction for Water Utilities (6)	Georgia Michigan Minnesota	North Dakota South Dakota Washington, D.C.

Source: Survey of state public utility commission staff members, January-February 1996.

Commission Policies on Single-Tariff Pricing for Water Utilities

State	Multi-System Utilities in the State (Q1)	Number of Multi-System Utilities (Q2)	Commission Approval of Single-Tariff Pricing (Q3)	Number of Utilities with Single Tariff Pricing (Q4)	Reasons for No Single-Tariff Pricing (Q5)	Has Single-Tariff Pricing Been Prohibited by Statute (Q6)	Monitor or Evaluate Single-Tariff Pricing (Q7)	Reason for approval (Q8)	Reason for Rejection (Q9)	Commission Policy (Q10)
Alabama	No	0	NA	NA	NA	NA	NA	NA	NA	NA
Alaska	No	0	NA	NA	NA	NA	NA	NA	NA	NA
Arizona	Yes	9	Yes	2	NA	No	No	Viability of systems	NA	Case-by-case
Arkansas	No	0	NA	NA	NA	NA	NA	NA	NA	NA
California	Yes	3	No (a)	0 (a)	Considered but not approved	No	No	NA	NA	Case-by-case
Colorado	No	0	NA	NA	NA	NA	NA	NA	NA	NA
Connecticut	Yes	12	Yes	10	NA	No	No	Mitigate rate shock	NA	Generally accepted
Delaware (b)	No	NA	NA	NA	NA	NA	NA	NA	NA	NA
Florida	Yes	60 to 70	Yes	20	NA	No (c)	No	Affordability; revenue stability; rate normalization for construction projects; simplified bookkeeping; reduced rate case expense.	NA	Case-by-case
Georgia	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Hawaii	No	0	NA	NA	NA	NA	NA	NA	NA	NA
Idaho	Yes	1	Yes	1	NA	No	No	Not an issue when proposed	NA	Case-by-case

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Commission Policies on Single-Tariff Pricing for Water Utilities

State	Multi-System Utilities in the State (Q1)	Number of Multi-System Utilities (Q2)	Commission Approval of Single-Tariff Pricing (Q3)	Number of Utilities with Single Tariff Pricing (Q4)	Reasons for No Single-Tariff Pricing (Q5)	Has Single-Tariff Pricing Been Prohibited by Statute (Q6)	Monitor or Evaluate Single-Tariff Pricing (Q7)	Reason for approval (Q8)	Reason for Rejection (Q9)	Commission Policy (Q10)
Illinois	Yes	4	Yes	2	NA	No	No	Reasonably consistent costs and source of supply	Difference in source-of-supply costs	Case-by-case
Indiana	Yes	2	No	0	Rejected	No	NA	NA	Cost-of-service; cost-based rates	Case-by-case
Iowa	Yes	1	No	0	Not an issue	No	NA	NA	NA	Never considered
Kansas	No	0	NA	NA	NA	NA	NA	NA	NA	NA
Kentucky	Yes	1	No	0	Not an issue	No (d)	NA	NA	NA (d)	Never considered
Louisiana	Yes	10	No	0	Not an issue	No	NA	NA	NA	Never considered
Maine	Yes	1	No	0	Not an issue	No	NA	NA	NA	Never considered
Maryland	Yes	2	No	0	Not an issue	No	NA	NA	NA	Case-by-case
Massachusetts	Yes	1	No (a)	0 (a)	Considered but not approved	No	No	Contiguity of communities; commonality of personnel; administrative convenience.	Need for further post-merger experience.	Case-by-case
Michigan	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Minnesota	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Mississippi	Yes	1	No	NA	Not an issue	No	NA	NA	NA	Case-by-case
Missouri	Yes	2	Yes	2	NA	No	No	Cost savings	NA	Generally accepted

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Commission Policies on Single-Tariff Pricing for Water Utilities

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Montana (b)	No	0	NA	NA	NA	NA	NA	NA	NA	NA
Nebraska	No	0	NA	NA	NA	NA	NA	NA	NA	NA
Nevada	No	0	NA	NA	NA	NA	NA	NA	NA	NA
New Hampshire	Yes	4	No (a)	0 (a)	Considered but not approved	No	NA	NA	NA	Case-by-case
New Jersey	Yes	3	No	0	Considered but not approved	No	NA	NA	NA	Case-by-case
New Mexico	No	0	NA	NA	NA	NA	NA	NA	NA	NA
New York	Yes	5	Yes	1	NA	No	No	Acceptable cost-of-service differentials	Cost-of-service differentials	Case-by-case
North Carolina	Yes	50	Yes	46	NA	No	No	More economical for utility and customers; less tracking required.	NA	Generally accepted
North Dakota	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Ohio	Yes	3	Yes	2	NA	No	No	Company request, cost savings, customer benefits.	NA	Case-by-case
Oklahoma	No	0	NA	NA	NA	NA	NA	NA	NA	NA
Oregon	Yes	1	Yes	1	NA	No	No	Public interest	NA	Generally accepted

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Commission Policies on Single-Tariff Pricing for Water Utilities

State	Multi-System Utilities in the State (Q1)	Number of Multi-System Utilities (Q2)	Commission Approval of Single-Tariff Pricing (Q3)	Number of Utilities with Single Tariff Pricing (Q4)	Reasons for No Single-Tariff Pricing (Q5)	Has Single-Tariff Pricing Been Prohibited by Statute (Q6)	Monitor or Evaluate Single-Tariff Pricing (Q7)	Reason for approval (Q8)	Reason for Rejection (Q9)	Commission Policy (Q10)
Pennsylvania (e)	Yes	11	Yes	7	NA	No	No	Economies of scale; mitigate rate shock associated with improvements; lessen bookkeeping and reporting.	NA	Generally accepted; case-by-case
Rhode Island	No	0	NA	NA	NA	NA	NA	NA	NA	NA
South Carolina	Yes	4	Yes	4	NA	No	No	Uniform cost allocation; lower billing costs; base charge covers most fixed costs.	NA	Generally accepted
South Dakota	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Tennessee	No	0	NA	NA	NA	NA	NA	NA	NA	NA
Texas	Yes	200 to 300	Yes	Most	NA	No	No	Regionalization, lower administrative cost	NA	Generally accepted and preferred
Utah	No	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vermont	Yes	1	No	NA	Rejected	No	NA	NA	Cross subsidization	Generally not accepted

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Commission Policies on Single-Tariff Pricing for Water Utilities

State	Multi-System Utilities in the State (Q1)	Number of Multi-System Utilities (Q2)	Commission Approval of Single-Tariff Pricing (Q3)	Number of Utilities with Single Tariff Pricing (Q4)	Reasons for No Single-Tariff Pricing (Q5)	Has Single-Tariff Pricing Been Prohibited by Statute (Q6)	Monitor or Evaluate Single-Tariff Pricing (Q7)	Reason for approval (Q8)	Reason for Rejection (Q9)	Commission Policy (Q10)
Virginia	Yes	4	Yes	4	NA	No	No	Spreads costs; separating small-system costs not always effective.	NA	Case-by-case
Washington	Yes	30	Yes	25	NA	No	No	Economies of scale for small systems	NA	Generally accepted
West Virginia (f)	Yes	26	Yes	17	NA	No	Yes (g)	Promotes regionalization; ratepayer equity; ratemaking treatment similarity (f).	Cost-of-service principles; customer contribution inequities (f).	Case-by-case
Wisconsin (h)	Yes	1	No	0	Not an issue	No	NA	NA	NA	Never considered
Wyoming (b)	No	NA	NA	NA	NA	NA	NA	NA	NA	NA
D.C.	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ

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Commission Policies on Single-Tariff Pricing for Water Utilities

State	Multi-System Utilities in the State (Q1)	Number of Multi-System Utilities (Q2)	Commission Approval of Single-Tariff Pricing (Q3)	Number of Utilities with Single Tariff Pricing (Q4)	Reasons for No Single-Tariff Pricing (Q5)	Has Single-Tariff Pricing Been Prohibited by Statute (Q6)	Monitor or Evaluate Single-Tariff Pricing (Q7)	Reason for approval (Q8)	Reason for Rejection (Q9)	Commission Policy (Q10)

(a) Partial rate consolidation has been approved; single-tariff pricing may bephased-in for some utilities.
(b) Response by phone or derived from *1995 Inventory of Commission-Regulated Water Systems;* no multi-system water utilities.
(c) Proposed legislation would require physical interconnection of systems for single-tariff pricing.
(d) Farmers Home Administration debt requirements prohibit, but the issue did not come before the commission.
(e) May be more multi-system water utilities in the state.
(f) The commission regulates public service districts. These data reflect primarily the views of staff involved in regulating the districts.
(g) Reevaluation of rate cases where single-tariff pricing has been implemented (for public service districts).
(h) Response applies to regulated investor-owned utilities only. The Commission also regulates municipal water utilities and state law requires single-tariff pricing throughout municipalities.

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Commission Policies on Single-Tariff Pricing for Water Utilities

State	Multi-System Utilities in the State (Q1)	Number of Multi-System Utilities (Q2)	Commission Approval of Single-Tariff Pricing (Q3)	Number of Utilities with Single Tariff Pricing (Q4)	Reasons for No Single-Tariff Pricing (Q5)	Has Single-Tariff Pricing Been Prohibited by Statute (Q6)	Monitor or Evaluate Single-Tariff Pricing (Q7)	Reason for approval (Q8)	Reason for Rejection (Q9)	Commission Policy (Q10)
Summary Data										
Yes	29	–	16	–	–	0	1	–	–	–
No	16	–	13	–	–	29	17	–	–	–
NA	0	–	16	–	32	16	27	28	38	16
NJ	6	–	6	–	6	6	6	6	6	6
Not an issue	–	–	–	–	7	–	–	–	–	–
Rejected	–	–	–	–	2	–	–	–	–	–
Considered but not approved	–	–	–	–	4	–	–	–	–	–
Generally accepted	–	–	–	–	–	–	–	–	–	8
Generally not accepted	–	–	–	–	–	–	–	–	–	1
Case-by-case	–	–	–	–	–	–	–	–	–	15
Never considered	–	–	–	–	–	–	–	–	–	5
Total	51	193	51	144	51	51	51			51

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
Alabama	NA	NA	NA	NA	NA	NA	
Alaska	NA	NA	NA	NA	NA	NA	
Arizona	Wilhoit Water Company	4	47	140	Yes	1993	
	Water Utility of Greater Tonopah, Inc.	7	4	67	Yes	1994	
	Arizona Water Company	20	176	8,120	No	NA	
	Big Park Water Company	3	10	1,400	No	NA	
	Citizens Utilities Company	5	416	20,000	No	NA	
	Congress Water Company	2	48	434	No	NA	
	Cordes Lakes Water Company	3	600	2,977	No	NA	
	Marana Water Service, Inc.	2	88	600	No	NA	
	United Utilities	12	22	1,229	No	NA	
Arkansas	NA	NA	NA	NA	NA	NA	
California	Cal Water Service Company	19	485	3,400	Partial	1990s	Phasing-in tariff, subject to cost analysis (a).
	Southern California Water Company	21	1,000	96,000	Partial	1990s	Phasing-in tariff, subject to cost analysis (a).
	California-American Water Company	5	7,000	40,000	No	NA	
Colorado	NA	NA	NA	NA	NA	NA	
Connecticut	Bridgeport Hydraulic Company	7	66	97,000	Yes	1986	
	Connecticut Water Company	16	42	27,000	Yes	1988	
	Connecticut-American Water Company	5	43	16,000	Partial	1985	Phasing-in rate.
	Crystal Water Company	3	480	2,204	Yes	1995	
	Eastern Connecticut Regional Water Co.	25	<5	249	Partial	1993	Six tariffs; phasing-in rate.

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
	Gallup Water Service Company	4	36	574	No	NA	
	Jewett City Water Company	4	20	1,331	Yes	1986	
	Olmstead Water Company	4	31	121	Yes	1995	
	Rural Water Company	20	2	244	Yes	1973	
	Topstone Hydraulic Company	3	41	237	Yes	1975	
	Tyler Lake Water Company	4	27	90	No	NA	
	United Water Connecticut Inc.	4	136	2,919	Yes	1993	
Delaware	NA	NA	NA	NA	NA	NA	
Florida (b)	Arredondo Utility Company	2	NR	NR	Yes	NR (b)	
	Clay Utility Company	2	NR	NR	Yes	NR (b)	
	Consolidated Water Works, Inc.	2	NR	NR	Yes	NR (b)	
	Florida Cities Water Company (Lee County)	2	NR	NR	Yes	NR (b)	Single-tariff for water only.
	Gulf Utility Company	2	NR	NR	Yes	NR (b)	Interconnected water; noninterconnected wastewater.
	Heartland Utilities, Inc	2	NR	NR	Yes	NR (b)	
	Holiday Utility Company, Inc.	2	NR	NR	Yes	NR (b)	
	Jacksonville Suburban Utilities Corp., Inc.	21	NR	NR	Partial	NR (b)	Three tariffs.
	Lake Utility Services, Inc.	11	NR	NR	Partial	NR (b)	Two tariffs.
	Lenvil H. Dicks	4	NR	NR	Yes	NR (b)	
	Mad Hatter Utility, Inc.	3	NR	NR	Yes	NR (b)	Noninterconnected water; interconnected wastewater.
	Marion Utilities, Inc.	23	NR	NR	Partial	NR (b)	Two tariffs.
	Neighborhood Utilities, Inc.	5	NR	NR	Yes	NR (b)	

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
	Ocala Oaks Utilities, Inc.	9	NR	NR	Yes	NR (b)	
	Pine Island Utility Corporation	2	NR	NR	Yes	NR (b)	
	Poinciana Utilities, Inc.	4	NR	NR	Yes	NR (b)	
	Rainbow Springs Utilities, Inc.	2	NR	NR	Yes	NR (b)	
	Seven Rivers Utilities, Inc.	3	NR	NR	Yes	NR (b)	
	Sunshine Utilities of Florida	20	NR	NR	Partial	NR (b)	Excludes 2 systems.
	Utilities, Inc.	16	NR	NR	Partial	NR (b)	Three tariffs.
Georgia	NJ	NJ	NJ	NJ	NJ	NJ	
Hawaii	NA	NA	NA	NA	NA	NA	
Idaho	Hayden Pines Water Company	10	12	646	Yes	1985	Not an issue when proposed.
Illinois	Citizens Utilities Company of Illinois	22	114	8,400	Partial	1965	Some exceptions based on source of supply differences.
	Illinois-American Water Company	5	1,700	65,200	Partial	1993	Phasing-in one system.
	Northern Illinois Water Corporation	4	4,000	40,200	No	NA	
	Consumers Illinois Water Company	8	200	19,200	No	NA	
Indiana	Indiana-American Water Company	16	NR	NR	No	NA	
	Hoosier Water	4	NR	NR	No	NA	
Iowa	Iowa-American Water Company	2	10,400	43,700	No	NA	
Kansas	NA	NA	NA	NA	NA	NA	
Kentucky	Southeastern W.D.	3	837	1,278	No	NA	
Louisiana	A.T.S.	NR	NR	NR	No	NA	
	Acadian Water & Sewer	NR	NR	NR	No	NA	
	Baton Rouge Water Company	NR	NR	NR	No	NA	

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
	Capital Utilities	NR	NR	NR	No	NA	
	Coast Water System	NR	NR	NR	No	NA	
	Hunstock Hills	NR	NR	NR	No	NA	
	Ascension Water Company	NR	NR	NR	No	NA	
	Louisiana Water Company	NR	NR	NR	No	NA	
	Parish Water Company	NR	NR	NR	No	NA	
	Utilities Data, Inc.	NR	NR	NR	No	NA	
Maine	Consumers Maine Water Company	7	408	7,192	No	NA	
Maryland	Utilities, Inc.	5	75	1,010	No	NA	
	Facilities Services, Inc.	7	31	130	No	NA	
Massachusetts	Massachusetts-American	3	2,400	11,000	Partial	1990	Two tariffs under a settlement agreement; a case is pending (a).
Michigan	NJ	NJ	NJ	NJ	NJ	NJ	
Minnesota	NJ	NJ	NJ	NJ	NJ	NJ	
Mississippi	Johnson Utility Company	32	12 to 15	600 to 750	No	NA	
Missouri	Missouri-American Water	7	500	2,800	Yes	1995	
	KMB Utilities	6	200	600	Yes	1995	
Montana	NA	NA	NA	NA	NA	NA	
Nebraska	NA	NA	NA	NA	NA	NA	
Nevada	NA	NA	NA	NA	NA	NA	
New Hampshire	Consumers New Hampshire Water	24	40	5,000	Partial	NR	Three tariffs; may be moving toward single tariff (a).

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
	Pennichuck Water Works	12	35	19,000	No	NA	
	Lakes Regional Water Company	11	30	200	No	NA	
	Carleton Water Company	4	30	175	No	NA	
New Jersey	New Jersey-American	2	272	329,000	No	NA	A case is pending.
	Elizabethtown Water Company	2	10,928	181,100	No	NA	
	Consumers New Jersey	7	422	28,652	No	NA	
New Mexico	NA	NA	NA	NA	NA	NA	
New York	Jamaica Water Supply	2	30,000	90,000	No	NA	Operated as one system until disconnected and extreme cost differentials became apparent
	South County Water	4	2	270	No	NA	Smallest serves two industrial customers.
	Rand Water	2	148	158	No	NA	
	Northwood Water	2	49	220	No	NA	
	Forest Park Water	6	30	60	Yes	1987	Commission imposed single-tariff pricing.
North Carolina	Alpha Utilities	11	18	121	Yes	1986	
	Bess Brothers	11	16	78	Yes	1971	
	Bogue Banks Water Company	3	80	3,830	Yes	1991	
	Bradshaw Water Company	5	10	41	Yes	1974	
	Brookwood Water Corporation	15	32	5,345	Yes	1974	
	Carolina Water Services of NC	72	13	2,790	Yes	1978	
	Clear Meadow Water	2	24	50	Yes	1981	

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
	Coastal Plains Utility Company	3	36	542	Yes	1967	
	Community Water Works	2	26	51	Yes	1975	
	Corriher Water Service	22	13	193	Yes	1968	
	Crabtree Water Systems	3	10	26	No	NA	
	Cross State Development Company	3	9	140	Yes	1974	
	CWS Systems	16	12	1,211	No	NA	
	D&W Water Systems	2	17	96	Yes	1987	
	Environmental Maintenance	3	20	132	No	NA	
	Fairways Utilities	3	9	296	Yes	1990	
	Fisher Utilities	18	13	184	Yes	1973	
	Fox Run Water Company	6	21	60	Yes	1989	
	Goss Utility Company	7	19	131	Yes	1976	
	Grandfather Golf and Country	2	45	156	Yes	1982	
	Heater Utilities	150	10	2,475	Yes	1972	
	Wayne M. Honeycutt	3	15	40	Yes	1978	
	Huffman Water Systems	10	11	83	Yes	1964	
	Hydraulics, Ltd.	85	4	191	Yes	1966	
	HydroLogic	4	15	64	No	NA	
	Kings Grant Water Company	7	96	850	Yes	1968	
	Knob Creek Utility	3	24	151	Yes	1984	
	Language Water Works Corp.	22	62	678	Yes	1969	
	Ira D. Lee & Assoc.	2	41	145	Yes	1986	
	Lewis Water Company	14	6	80	Yes	1980	

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
	Lincoln Water Works	2	21	122	Yes	1972	
	William K. Mauney	2	19	24	Yes	1976	
	Mercer Environmental	10	47	479	Yes	1965	
	Mid South Water Systems	201	7	429	Yes	1981	
	Giles E. Mullis	2	20	20	Yes	1983	
	Norwood Beach Water System	4	10	36	Yes	1995	
	Piedmont Construction & Water	47	7	147	Yes	1970	
	Prior Construction Company	2	11	184	Yes	1988	
	Quality Water Supplies	14	37	257	Yes	1967	
	Rayco Utilities	10	12	104	Yes	1987	
	Scientific Water & Sewage	5	106	537	Yes	1964	
	Scotland Water	4	39	91	Yes	1983	
	Scotsdale Water & Sewage	15	7	205	Yes	1990	
	Setzer Brothers Well Boring	3	30	72	Yes	1972	
	Spring Water Company	2	17	139	Yes	1977	
	Surry Water Company	30	8	206	Yes	1972	
	Turner Farms	4	20	127	Yes	1982	
	Water Resources	2	9	81	Yes	1993	
	West Wilson Water Company	6	15	74	Yes	1988	
	Woods Water Works	4	5	18	Yes	1981	

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
North Dakota	NJ	NJ	NJ	NJ	NJ	NJ	
Ohio	Ohio-American Water	8 or 9	300	15,000	Yes	1975 to 1983	
	Citizens Utilities	6	278	3,023	Yes	1975 to 1983	
	Consumers Ohio Water	4	7,516	25,254	No	NA	
Oklahoma	NA	NA	NA	NA	NA	NA	
Oregon	Avion Water Company, Inc.	4	52	5,750	Yes	Early 1970s	
Pennsylvania	Pennsyvania-American Water Company	27	NR	NR	Yes	1970s & 1980s	Interconnected systems (1970s); noncontiguous systems (1980s).
	United Water Pennsylvania, Inc.	22	NR	NR	Partial	1992	Excludes one system.
	Consumers Pennsylvania Water Company	10	NR	NR	Partial	NR	Three rate zones.
	Citizens Utilities Water Company of PA	20	NR	NR	Partial	NR	Five rate zones.
	National Utilities, Inc.	21	NR	NR	Partial	NR	Three rates and four systems with their own tariffs.
	Philadelphia Suburban Water Company	15	NR	NR	Partial	NR	Most acquisitions adopt the single tariff; excludes two systems.
	Newtown Artesian Water Company	2	NR	NR	Yes	1994	Merger of two companies.
	Redstone Water Compnay, Inc.	3	NR	NR	No	NA	Three rate zones and four systems with separate tariffs.
	Frank Sargent	4 to 5	NR	NR	No	NA	May be moving toward single tariff.
	Blaine Rhodes	5	NR	NR	No	NA	May be moving toward single tariff.
	Carl Kreisge	2 to 3	NR	NR	No	NA	May be moving toward single tariff.

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
Rhode Island	NA	NA	NA	NA	NA	NA	
South Carolina	Carolina Water Service Inc.	53	18	1,500	Yes	1987	
	Heater Utilities, Inc.	38	5	250	Yes	1990	
	Blue Ribbon H2O Corporation	34	5	300	Yes	1995	
	Upstate Heater Utilities Inc.	21	20	50	Yes	1994	
South Dakota	NJ	NJ	NJ	NJ	NJ	NJ	
Tennessee	NA	NA	NA	NA	NA	NA	
Texas	*Data not easily available*			*-Not reported-*			*Single-tariff pricing is preferred; a special procedure is used to implement the tariff in conjunction with acquisitions.*
Utah	NA	NA	NA	NA	NA	NA	
Vermont	Sunshine Water Company	4	12	40	No	NA	
Virginia	Alpha Water Corporation	28	10	200	Yes	1984	
	Heritage Homes of Virginia	8	11	29	Yes	1994	
	New River Water Company	14	7	126	Yes	1993	
	Pocahontas Water Works	2	60	68	Yes	1958	
Washington (c)	Alderton-McMillin Water Supply, Inc.	8	NR	NR	Yes	NR	
	Aquarius Utilities, Inc.	4	NR	NR	Yes	NR	
	Arcadia Utilities	11	NR	NR	No	NA	
	Bethel Water Company	3	NR	NR	Yes	NR	
	Evergreen Land & Water, Inc.	6	NR	NR	Yes	NR	System under receivership.
	Gamble Bay Water, Inc.	10	NR	NR	Yes	NR	

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
	H & R WaterWorks, Inc.	8	NR	NR	Yes	NR	
	H2O Company, The	2	NR	NR	No	NA	
	Harbor Water Company, Inc.	79	NR	NR	Yes	NR	
	Iliad Water Services, Inc.	12	NR	NR	No	NA	
	Lara Lee, Inc.	6	NR	NR	Yes	NR	
	Mainland View Manor Maintenance Co.	5	NR	NR	Yes	NR	
	Marvin Road Water Company	4	NR	NR	Yes	NR	
	Mirrormont Srevices, Inc.	2	NR	NR	Yes	NR	
	Monterra, Inc. (Washington Water Systems)	2	NR	NR	Yes	NR	
	Northwest Water Systems, Inc.	13	NR	NR	Yes	NR	
	Pattison Water Comapny	4	NR	NR	Yes	NR	
	Point Fosdick Water Company, Inc.	4	NR	NR	Yes	NR	
	Rainier View Water Company, Inc.	4	NR	NR	Partial	NR	Excludes 1-2 systems.
	Sanderson & Associates, Inc.	13	NR	NR	Yes	NR	
	Satellite Water Systems	25	NR	NR	No	NA	
	S-K Pump & Drilling	39	NR	NR	Yes	NR	
	Soren Pedersen Water Company	2	NR	NR	No	NA	
	Sound Water Company, Inc.	4	NR	NR	Yes	NR	
	South Bainbridge Water System, Inc.	2	NR	NR	Yes	NR	
	South Sound Utility Company, Inc.	35	NR	NR	Yes	NR	
	Stroh Water Company	5	NR	NR	Partial	NR	Excludes 1-2 systems.
	Sunshine Acres Water System	4	NR	NR	Yes	NR	
	Thomas Water Service, Inc.	2	NR	NR	Yes	NR	

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
	Washington Water Supply, Inc.	9	NR	NR	Yes	NR	
West Virginia (d)	West Virginia-American	13	571	68,636	Yes	1982	Formerly 12 to 14 districts.
	Arbuckle	2	NR	NR	Yes	Prior to 8/85	
	Central Hampshire	2	NR	NR	No	NA	
	Friendly	2	NR	NR	Yes	Prior to 4/88	
	Gilmer County	2	NR	NR	Yes	Prior to 12/90	
	Grant County	2	NR	NR	Yes	Prior to 9/83	
	Green Valley-Glenwood	2	NR	NR	Yes	Prior to 6/80	
	Hammond	2	NR	NR	Yes	1982	
	Hardy County	2	NR	NR	No	NA	
	Jefferson County	3	NR	NR	No	NA	
	Kopperston	2	NR	NR	Yes	1981	
	Logan County	5	NR	NR	Yes	1995	
	Mannington	2	NR	NR	Yes	Prior to 3/82	
	Mason County	3	NR	NR	No	NA	
	McDowell County	6	NR	NR	No	NA	
	Oakland	2	NR	NR	Yes	Prior to 5/84	
	Ohio County	3	NR	NR	Yes	Prior to 1/81	
	Pendleton County	4	NR	NR	No	NA	
	Preston County #1	2	NR	NR	Yes	Prior to 2/81	
	Preston County #2	2	NR	NR	Yes	Prior to 12/81	
	Raleigh County	3	NR	NR	No	NA	
	Red Sulphur	2	NR	NR	Yes	Prior to 8/83	

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
	South Putnam	2	NR	NR	No	NA	
	Van	2	NR	NR	No	NA	
	Washington Pike	2	NR	NR	Yes	Prior to 7/80	
	Wyoming-Glover	2	NR	NR	Yes	Prior to 2/85	
Wisconsin	Wisconsin Power & Light	2	2,661	13,752	No	NA	
	Several towns with two or three systems			*-Not reported-*			*Single-tariff pricing is required for municipal utilities.*
Wyoming	NA	NA	NA	NA	NA	NA	
D.C.	NJ	NJ	NJ	NJ	NJ	NJ	

(a) Single-tariff pricing has not been explictly approved, but some rate consolidation has occurred (three states; four systems).
(b) Only utilities with single-tariff pricing for all or some systems are reported. These rates were approved over time, dating back to at least the early 1980s Data were not reported for all multi-system utilities in the state.
(c) Flat rates and metered rates may exist within the same tariff. Similarly, mobile home parks and multi-dwelling units may exist at a separate rate within the same tariff.
(d) Only West-Virginia is investor-owned; the rest are public service districts. Only multi-system utilities are reported;interconnected systems and single-systems with multiple tariffs are not included.

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
Summary Data for All Utilities							
Yes		--	--	--	128	--	
Partial		--	--	--	20	--	
No		--	--	--	65	--	
Total		--	--	--	213	--	
Minimum		2	2	18	--	--	
Maximum		201	30,000	329,000	--	--	
Average		11	751	11,615	--	--	
Median		4	30	257	--	--	
Utilities reported		203	115	115	--	--	

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Multi-System Water Utilities and Single-Tariff Pricing

State	Name of Multi-System Water Utility (Q2)	Approximate Number of Systems (Q2)	Smallest System (N Connections) (Q2)	Largest System (N Connections) (Q2)	Single-Tariff Pricing Approved (Q4)	Approximate Date of Approval (Q4)	Notes
Summary Data for Single-Tariff Utilities							
Yes		--	--	--	128	--	
Partial		--	--	--	20	--	
No		--	--	--	0	--	
Total		--	--	--	148	--	
Minimum		2	2	18	--	1958	
Maximum		201	2,400	97,000	--	1995	
Average		13	123	5,721	--	1982	
Median		5	20	197	--	1983	
Utilities reported		148	80	80	--	79	
Summary Data for Multi-System Utilities Without Single Tariff							
Yes		--	--	--	0	--	
Partial		--	--	--	0	--	
No		--	--	--	65	--	
Total		--	--	--	0	--	
Minimum		2	2	26	--	--	
Maximum		32	30,000	329,000	--	--	
Average		6	2,187	25,088	--	--	
Median		4	75	1,229	--	--	
Utilities reported		55	35	35	--	--	

Notes: For reponses reported as a range of values, averages were used (for example, "8 to 9" was averaged to "8.5"). For the response "< 5," a value of 4.5 was used.

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COMPARATIVE ANALYSIS OF MULTI–SYSTEM UTILITIES WITH AND WITHOUT SINGLE–TARIFF PRICING

Utilities	Number of Utilities Reported		Approximate Number of Systems				Smallest System (# Connections)				Largest System (# Connections)			
	Approx Systems	Number of Connections	Minimum	Maximum	Average	Median	Minimum	Maximum	Average	Median	Minimum	Maximum	Average	Median
All Utilities	203	115	2	201	11	4	2	30,000	751	30	18	329,000	11,615	257
Single–Tariff Utilities	148	80	2	201	13	5	2	2,400	123	20	18	97,000	5,721	197
Multi–System Utilities Without Single–Tariff Pricing	55	35	2	32	6	4	2	30,000	2,187	75	26	329,000	25,088	1,229

Arguments in Favor of Single-Tariff Pricing (a)

State	Regionalization Incentives	Mitigates Rate Shock	Universal Service	Regional Equity	Service Affordability	Small-System Viability	Compliance with Standards	Similar Ratemaking to Other Utilities	Lowers Admin. Costs to Utility	Lowers Admin. Costs to Commission	Regional Economic Development	Encourages Private Involvement	Encourages Investment	Interconnection Not Required	Overall Benefits Outweigh Costs	Other	Number of "Yes" Responses
Alabama	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alaska	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arizona	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes	No	No	No	Yes	Yes	No	8
Arkansas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
California	No	Yes	Yes	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No	4
Colorado	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Connecticut	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	14
Delaware	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Florida	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	13
Georgia	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Hawaii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Idaho	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Illinois	Yes	Yes	No	No	No	No	Yes	No	Yes	No	No	No	No	Yes	Yes	No	6
Indiana	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	2
Iowa	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Kansas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kentucky	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Louisiana	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Maine	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Maryland	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Massachusetts	No	No	No	Yes	No	No	No	No	Yes	No	No	No	No	Yes	No	No	3
Michigan	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Minnesota	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Mississippi	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

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Arguments in Favor of Single-Tariff Pricing (a)

State	Regionalization Incentives	Mitigates Rate Shock	Universal Service	Regional Equity	Service Affordability	Small-System Viability	Compliance with Standards	Similar Ratemaking to Other Utilities	Lowers Admin. Costs to Utility	Lowers Admin. Costs to Commission	Regional Economic Development	Encourages Private Involvement	Encourages Investment	Interconnection Not Required	Overall Benefits Outweigh Costs	Other	Number of "Yes" Responses
Missouri	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	No	No	Yes	Yes	No	No	7
Montana	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nebraska	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nevada	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Hampshire	Yes	Yes	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No	4
New Jersey	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No	No	8
New Mexico	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New York	No	No	No	No	No	No	No	No	Yes	No	No	No	No	Yes	No	Yes (b)	3
North Carolina	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	No	Yes	No	No	Yes	Yes	No	9
North Dakota	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Ohio	Yes	Yes	No	No	Yes	Yes	No	No	Yes	No	No	No	No	Yes	No	No	6
Oklahoma	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Oregon	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	No	12
Pennsylvania	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	Yes	Yes	No	11
Rhode Island	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
South Carolina	No	Yes	Yes	No	No	No	No	Yes	Yes	No	No	No	No	No	No	No	4
South Dakota	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Tennessee	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Texas	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No	No	6
Utah	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vermont	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	0
Virginia	Yes	Yes	No	No	Yes	No	No	Yes	Yes	Yes	No	No	No	No	No	No	6
Washington	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	14
West Virginia	Yes	No	No	Yes	Yes	No	No	Yes	No	No	No	No	No	Yes	Yes	No	6

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Arguments in Favor of Single-Tariff Pricing (a)

State	Regionalization Incentives	Mitigates Rate Shock	Universal Service	Regional Equity	Service Affordability	Small-System Viability	Compliance with Standards	Similar Ratemaking to Other Utilities	Lowers Admin. Costs to Utility	Lowers Admin. Costs to Commission	Regional Economic Development	Encourages Private Involvement	Encourages Investment	Interconnection Not Required	Overall Benefits Outweigh Costs	Other	Number of "Yes" Responses
Wisconsin	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Wyoming	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D.C.	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ

Summary Data

Yes	15	17	8	6	12	12	9	10	16	8	3	2	5	13	9	1	–
No	6	4	13	15	9	9	12	11	5	13	18	19	16	8	12	20	–
NI	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	–
NA	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	–
NJ	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	–
Total	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	–

(a) These findings reflect staff views about the arguments affecting commission deliberations or policies.
(b) Can be consistent with cost-of-service principles.

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Arguments Against Single-Tariff Pricing (a)

State	Conflict with Cost-of-Service	Undermines Economic Efficiency	Subsidies to High-Cost Customers	Distorts Price Signals	Discourages Efficient Water Use	Encourages Growth in High-Cost Areas	Encourages Overinvestment	Fails to Account for Contributions	Unnecessary Incentives	Inappropriate Without Interconnection	Not Acceptable to All Customers	Not Acceptable to Agencies	Not Justified in a Specific Case	Insufficient Precedents	Overall Costs Outweigh Benefits	Other	Number of "Yes" Responses
Alabama	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Alaska	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arizona	Yes	No	Yes	No	No	Yes	No	No	No	Yes	Yes	No	No	No	No	No	5
Arkansas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
California	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	No	No	No	No	7
Colorado	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Connecticut	Yes	No	Yes	No	No	Yes	No	No	No	Yes	Yes	No	No	Yes	No	No	6
Delaware	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Florida	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	15
Georgia	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Hawaii	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Idaho	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Illinois	Yes	No	No	No	No	No	No	No	No	No	No	No	Yes	No	Yes	No	3
Indiana	Yes	No	No	No	No	No	No	Yes	No	No	Yes	No	Yes	No	No	No	4
Iowa	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Kansas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kentucky	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Louisiana	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Maine	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Maryland	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Massachusetts	Yes	No	No	No	No	No	No	No	No	Yes	No	No	Yes	No	No	No	3
Michigan	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Minnesota	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Mississippi	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

NA = Not applicable; NR = Not reported; NJ = No jurisdiction; NI = Not an issue

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Arguments Against Single-Tariff Pricing (a)

State	Conflict with Cost-of-Service	Undermines Economic Efficiency	Subsidies to High-Cost Customers	Distorts Price Signals	Discourages Efficient Water Use	Encourages Growth in High-Cost Areas	Encourages Overinvestment	Fails to Account for Contributions	Unnecessary Incentives	Inappropriate Without Interconnection	Not Acceptable to All Customers	Not Acceptable to Agencies	Not Justified in a Specific Case	Insufficient Precedents	Overall Costs Outweigh Benefits	Other	Number of "Yes" Responses
Missouri	Yes	No	Yes	Yes	No	No	No	Yes	No	Yes	No	No	No	No	No	No	5
Montana	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nebraska	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nevada	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Hampshire	Yes	No	Yes	No	No	No	No	Yes	No	Yes	Yes	No	No	No	No	No	5
New Jersey	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	0
New Mexico	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New York	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	No	Yes	No	No	No	9
North Carolina	Yes	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	3
North Dakota	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Ohio	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	0
Oklahoma	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Oregon	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	0
Pennsylvania	Yes	No	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No	No	3
Rhode Island	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
South Carolina	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	0
South Dakota	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Tennessee	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Texas	No	No	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No	No	2
Utah	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vermont	No	No	Yes	Yes	No	No	No	No	No	Yes	Yes	No	No	No	No	No	4
Virginia	Yes	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	No	No	3
Washington	No	No	No	Yes	Yes	No	No	No	No	No	Yes	No	No	No	No	No	3
West Virginia	Yes	No	No	No	No	No	No	Yes	No	No	No	No	Yes	No	No	No	3

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Arguments Against Single-Tariff Pricing (a)

State	Conflict with Cost-of-Service	Undermines Economic Efficiency	Subsidies to High-Cost Customers	Distorts Price Signals	Discourages Efficient Water Use	Encourages Growth in High-Cost Areas	Encourages Overinvestment	Fails to Account for Contributions	Unnecessary Incentives	Inappropriate Without Interconnection	Not Acceptable to All Customers	Not Acceptable to Agencies	Not Justified in a Specific Case	Insufficient Precedents	Overall Costs Outweigh Benefits	Other	Number of "Yes" Responses
Wisconsin	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Wyoming	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D.C.	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ

Summary Data

Yes	14	3	12	7	4	4	1	6	2	8	10	2	6	2	2	0	–
No	7	18	9	14	17	17	20	15	19	13	11	19	15	19	19	21	–
NI	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	–
NA	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	–
NJ	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	–
Total	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	–

(a) These findings reflect staff views about the arguments affecting commission deliberations or policies.

NA = Not applicable; NR = Not reported; NJ = No jurisdiction; NI = Not an issue

FLORIDA PUBLIC SERVICE COMMISSION
DOCKET
NO. 950495 EXHIBIT NO. 133
COMPANY/
WITNESS:
DATE: 2/29/96

The National Regulatory Research Institute

DOCKET 950495-WS
EXHIBIT NO. 133
CASE NO. 96-04227

COST ALLOCATION AND RATE DESIGN FOR WATER UTILITIES

December 1990

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NRRI 90-17

COST ALLOCATION AND RATE DESIGN FOR WATER UTILITIES

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Cost allocation is inexact; no single correct approach or method exists. Much depends on the criteria used by analysts. All cost studies involve judgments and should be viewed as a starting point. The choice of a cost allocation approach depends largely on utility management objectives and regulatory policy considerations. In the context of increasing pressure on water rates, a comparison of fully allocated (also known as fully distributed or embedded) cost analysis and marginal-cost analysis is warranted. Fully allocated and marginal-cost calculations both can provide decisionmakers with useful benchmarks for ratemaking as well as planning. These methods can produce divergent results. As a method of compromise, fully allocated costs can be used to determine revenue requirements while marginal costs can be used to design rates. Incremental least-cost analysis is proposed in this report as a marginal-cost ratemaking approach that emphasizes the practical application of least-cost planning criteria to ratemaking.

The theoretical pricing standard is to set rates equal to the cost of service; that is, rate differentials are based on cost differentials. However, to maintain this standard, cost differentials must be sufficiently defined. For example, if there are no marked differences in the cost of providing different volumes of service, it may be more appropriate to adopt a uniform commodity rate than a decreasing-block or increasing-block rate.

Despite the availability of many alternatives, water rate design leaves much discretion to decisionmakers. As in selecting a cost allocation method, the choice of rate design involves tradeoffs among the goals of efficiency, equity, revenue adequacy, and administrative feasibility. Rates that are equitable may not be efficient or perceived as affordable; rates that are perceived as affordable may not be efficient or generate sufficient revenues; rates that are efficient may not be administratively practical. The inclination to promote economic development or conservation policies through rate design must be considered within the context of basic ratemaking objectives and the tradeoffs among them. Decisionmakers may find it increasingly difficult to balance the competing perspectives that are inherent in the ratemaking process.

Finally, it is important to recognize that improved costing and pricing of water utility service, though essential to economic efficiency, is not a panacea for all the problems confronting water utilities and their regulators. Other issues and solutions merit further study as well.

costly new treatment technologies, additions to capacity to accommodate growth, and replacement and upgrading of aging infrastructure. Secondary factors include rising energy costs and inflation. Today, the potential for substantial water rate increases and accompanying rate shock looms large, rivaling the past experience of the nation's energy utilities. Changes in pricing policies to encourage conservation and the wise use of water may add to the upward pressure on water rates. As rates rise, so does concern about consumer willingness and ability to pay for water service. All of these issues place demands on water supply managers and regulators as they evaluate cost allocation and rate design alternatives.

Cost allocation and rate design are distinct but intrinsically related processes. The usual purpose of analyzing costs is to provide a basis for setting rates. Likewise, contemporary rate design emphasizes the determination of *cost-based* rates; indeed this objective has become fundamental to utility ratemaking. This report provides essentially a status report on cost allocation and rate design for water utilities. It draws upon theoretical as well as practical knowledge about these topics and provides a basis for evaluating some of the available alternatives. While the focus is mainly on privately owned and state regulated water utilities, the study has broader applicability to other water service providers, all of whom are confronted with cost allocation and rate design issues.

This chapter provides an overview of the issues of value, cost, and price, and a framework for the remainder of the analysis. Chapter 2 provides a description of the water supply industry. Chapter 3 reviews cost allocation, focusing on the embedded cost approach, while chapter 4 reviews conceptual and application issues related to marginal (incremental) cost pricing. Chapter 5 turns to issues of rate design. Chapter 6 offers concluding remarks and is followed by a series of technical appendices, including a glossary of terms and a bibliography. Though not a practitioner's manual, this report lays a foundation for further exploration of cost allocation and rate design for water utilities at a time when these concerns are increasingly salient.

Value, Cost, and Price[6]

Value, cost, and price are intrinsically related and highly interdependent concepts. Although understanding each concept greatly helps in understanding the others, they are distinct in that each evokes a different set of considerations in the water supply field.

Water is a value-added commodity. Its value raises issues of scarcity, competition, and the need for integrated water resource planning. An increasing awareness of water's value has led some to adopt a wise-use approach to its consumption, including--but not limited to--conservation. The cost of supplying water is increasing, especially the expense of complying with safe drinking water regulations. Cost issues also raise questions related to economies of scale and the structural character of the water supply industry. Finally, pricing deals with sending appropriate signals to customers about the value and cost of water. Value-of-service and cost-of-service pricing are contrasting (but not necessarily incompatible) approaches. In the regulatory context, pricing is a part of the process by which revenue requirements are determined, costs allocated, and tariffs designed.

The Value of Water

Of the approximately 340 billion gallons of water withdrawn daily in the United States from surface and ground sources, only about 11 percent is used by public water suppliers. Public suppliers "compete" for water withdrawals mainly against water use in agriculture and electricity generation. The value of water used by public utilities is somewhat dependent on the value society places on other water uses. Over the past several decades, competition for water has intensified greatly, partly because some water sources have reached their carrying capacities or have become impaired either by natural or manmade causes.

Globally, water in its natural state is abundant and renewable, but remains finite and nonrenewable in some respects. For instance, water is nonrenewable when it comes from a severely depleted or contaminated groundwater source. Water

[6] See Janice A. Beecher, "Value, Cost, and Price: Essay on Emerging Water Utility Issues," *NRRI Quarterly Bulletin* 11 no. 2 (June 1990): 177-181.

Because of economies of scale in water supply, there is a growing interest in structural options for water utilities (such as regionalization, mergers, and acquisitions) particularly when very small systems can be absorbed by larger ones that are more financially viable. There is also a growing interest in "nonproliferation" of small systems, that is, in preventing these very small (and often eventually troubled) systems from coming into existence in the first place.

For water utilities that fall under the jurisdiction of regulators, cost recovery is closely related to the issue of management prudence. Regulators will want assurances that least-cost alternatives are being pursued, including improvements both to supply and demand management. Keeping costs down may emerge as the first priority of water suppliers and their regulators. On the other hand, for consumers to value water service accurately, they must realize its true economic costs. This raises the issue of price.

The Price of Water

Prices that accurately reflect costs send correct signals to consumers about the value and cost of water, and thereby encourage wise use and discourage wasteful consumption. Nevertheless, prices in many areas may not adequately reflect the cost of providing water service. Further, the absence of metering, the use of rates unrelated to usage, and subsidization to or from nonutility functions are especially problematic. So is the use of embedded accounting costs in setting rates. Many contemporary pricing strategies are based on the idea of marginal cost, which is the additional cost of producing or selling a single incremental unit.[10] Not everyone agrees with marginal-cost pricing and (not surprisingly) the biggest difficulty in applying it is estimating marginal costs, which depend on assumptions about when the next increment of supply will be added, where it will come from, and how much it will cost. Marginal-cost estimation requires detailed and accurate cost data as well as extra effort on the part of water suppliers and their regulators. For small utilities, it may be a highly impractical approach.

Setting prices also entails assessing the potential effect of a change in price on consumption. The conservation of centrally supplied water through pricing is

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[10] See Patrick C. Mann, and Donald L. Schlenger, "Marginal Cost and Seasonal Pricing of Water Service," *American Water Works Association Journal* 74 no. 1 (January 1982): 6-11.

largely a function of the price elasticity of water demand, which is somewhat variable. Outdoor use, for example, is more price-elastic than indoor use. Some water rate structures--such as increasing block and seasonal rates--are specifically designed for conservation purposes, although disagreement exists over their use. As the cost of water treatment increases, greater attention must be paid to the issue of rate design and alternative rate structures, such as seasonal pricing. It also may be necessary to reconcile value-based and cost-based pricing through less conventional rate structures, such as scarcity pricing or excess-use charges.

Finally, one potential result of higher costs for water treatment is rate shock, especially for consumers served by utilities whose rates are currently very low.[11] Water suppliers and regulators may need to look for ways to mitigate rate shock, including rate phase-in plans similar to those that have been applied to nuclear plants in the electricity sector.[12] For any pricing scheme, however, the effects on utility investors in the regulatory context must be examined.

For a water supplier, generating revenues may be the primary consideration. For the ratepayer, the critical issue is price. As prices rise, some customers will seek substitutes, such as bottled water and reliance on their own wells. Others will seek technological solutions--recycling and low-use devices. Still others simply will change their water use habits. In the worst case, some may be unable to afford water that is safe to drink. Policymakers then will have to deal with the implications of such cases. If higher prices accurately reflect water service cost, however, many customer complaints will be difficult to resolve.

Pricing and resource conservation are inseparable issues because of the relationships of price to quantity demanded. From the viewpoint of economic theory, price is essential to the appropriate valuation, consumption, and conservation of resources. Without correct price signals, consumers may overconsume or underconsume water. Historically, weak price signals characterized by low water prices may be associated with too little conservation. In the future, that situation is likely to change.

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11 See Mann and Beecher, *Cost Impact*.

12 Another view is that rate shock is necessary and even desirable for sending accurate pricing signals that lead to changes in consumption behavior. In this view, the effects of rate increases should not be mitigated through phase-in plans or other measures.

TABLE 1-1

THREE PERSPECTIVES ON RATEMAKING

Utility's Perspective

- Does the rate structure fully compensate the utility so that revenue requirements are met?
- Does the rate structure allow the utility to earn a fair return on its investment?
- Is the rate structure strategically sound for load management, competition, and long-term planning?

Consumer's Perspective

- Are both the ratemaking process and the rate structure equitable?
- Are utility rates perceived to be affordable?
- Are both the ratemaking process and the rate structure understandable?

Society's Perspective

- Does the rate structure promote economic efficiency?
- Does the rate structure promote the appropriate valuation and conservation of resources?
- Does the ratemaking process take into account priority uses of water?
- Are both the ratemaking process and the rate structure just and reasonable?

Source: Authors' construct.

TABLE 1-2

ATTRIBUTES OF A SOUND RATE STRUCTURE

Revenue-related Attributes

1. Effectiveness in yielding total revenue requirements under the fair-return standard without any socially undesirable expansion of the rate base or socially undesirable level of product quality and safety.
2. Revenue stability and predictability, with a minimum of unexpected changes seriously adverse to utility companies.
3. Stability and predictability of the rates themselves, with a minimum of unexpected changes seriously adverse to ratepayers and with a sense of historical continuity.

Cost-related Attributes

4. Static efficiency of the rate classes and rate blocks in discouraging wasteful use of service while promoting all justified types and amounts of use:
   (a) in the control of the total amounts of service supplied by the company;
   (b) in the control of the relative uses of alternative types of service by ratepayers (on-peak versus off-peak service or higher quality versus lower quality service).
5. Reflection of all of the present and future private and social costs and benefits occasioned by a service's provision (i.e., all internalities and externalities).
6. Fairness of the specific rates in the apportionment of total costs of service among the different ratepayers so as to avoid arbitrariness and capriciousness and to attain equity in three dimensions: (1) *horizontal* (i.e., equals treated equally); (2) *vertical* (i.e., unequals treated unequally); and (3) *anonymous* (i.e., no ratepayer's demands can be diverted away uneconomically from an incumbent by a potential entrant).
7. Avoidance of undue discrimination in rate relationships so as to be, if possible, compensatory (i.e., subsidy free with no intercustomer burdens).
8. Dynamic efficiency in promoting innovation and responding economically to changing demand and supply patterns.

Practical-related Attributes

9. The related, practical attributes of simplicity, certainty, convenience of payment, economy in collection, understand-ability, public acceptability, and feasibility of application.
10. Freedom from controversies as to proper interpretation.

Source: James C. Bonbright, Albert L. Danielsen, and David R. Kamerschen, *Principles of Public Utility Rates* (Arlington, VA: Public Utilities Reports, 1988), 382-84.

TABLE 1-3

COST ALLOCATION AND RATE DESIGN FOR WATER UTILITIES: DECISION AREAS AND PRINCIPAL CONSIDERATIONS

Decision Areas	Principal Considerations
Identification of Revenue Requirement	Capital investments/rate base Return on rate base Operation and maintenance expenses Depreciation Taxes
Cost Functionalization	Source development Pumping Transmission Treatment Storage Distribution Nontraditional supply
Cost Classification	Customer costs Capacity (demand) costs Commodity (operating) costs
Cost Allocation	Functional cost Commodity demand Base-extra capacity Embedded direct Fully distributed Marginal/incremental
Cost Assignment	Residential Commercial Industrial Wholesale Institutional Public authorities Fire protection

TABLE 1-3 (continued)

Decision Areas	Principal Considerations
Rate Design	Flat fees Fixture rates Uniform rates Decreasing block pricing Increasing block pricing Seasonal rates Excess use charges Indoor/outdoor rates Lifeline rates Sliding scale pricing Scarcity pricing Spatial pricing
Tariff Design	Customer charges Capacity (demand) charges Commodity (operating) charges Dedicated-capacity charges Capital contributions Fire protection charges Ancillary charges

Source: Authors' construct.

The analyst then chooses a cost allocation method for attributing costs to their respectives causes. Some of the methods used are functional cost, commodity demand, base-extra capacity, embedded direct, fully distributed, and marginal (or incremental). Next is the assignment of costs to classes of service. Some typical service classes in water supply are residential, commercial, industrial, wholesale, institutional, public authorities, and fire protection. Finally, rates for each customer class presumably based on the cost of serving them are established. There are many potential water rate structures, some of which appear in table 1-3. The resulting tariff, or authorized list of water service charges, may consist of customer, capacity, and commodity charges as well as special charges for dedicated capacity, capital contributions, fire protection, and ancillary services. Some charges (such as customer charges) are fixed, meaning they do not vary with water usage; others (such as commodity charges) are variable, meaning they do vary with water usage.

The decision areas in cost allocation and rate design are distinct but overlap considerably. Decisions about costs may affect the choice of methodology; decisions about customer classes may affect the choice of a rate structure. The resulting rates should allow the utility to meet its revenue requirements. There are also many subtle and not-so-subtle issues that emerge in the course of ratemaking that require an analyst's judgment. Because there is no such thing as a typical water utility, there may be few precedents or rules of thumb on which to rely. In practice, convenience, expedience, and tradition probably affect ratemaking for water utilities as much as economic analysis.

Generally, the cost-of-service standard has prevailed in setting water rates. This means setting rates that generate revenues from each user group equal to the cost of serving that group. That is, the user class that causes the expense absorbs the cost in rates paid for water service. The cost-of-service concept implies equal treatment for users with equal costs and rate differentials reflecting cost differences. This presumes, however, that water service costs are easily ascertainable for specific user groups. In many cases, cost-of-service analyses ignore the distinction between average (unit) costs and marginal (incremental) costs, between short-run and long-run costs, and between peak and off-peak costs of services. Water rates, as with other public utility rates, are based on averaging (that is, the average users having an average load factor); price discrimination is inherent.

Although cost-based, water utility ratemaking generally has not made use of sophisticated cost allocation methodologies (to identify cost causers) and rate design alternatives (to assign costs to customers).[18] Limited regulatory resources are the leading explanation for why this is so. Moreover, water rates have been affected by other factors, such as political considerations, tradition, value of service, and legal constraints. For example, many water rates have been adopted on the basis of either minimal customer complaint or consistency with the rates of adjacent communities. In brief, setting water rates involves a combination of analysis and expedience as well as a desire to balance competing policy goals. However, in the increasingly complex realm of water utility ratemaking, particularly in light of rising costs and prices, these issues are worth exploring.

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[18] There are exceptions. Articles appearing in the *American Water Works Association Journal* are a good source on new approaches.

CHAPTER 3

COST ALLOCATION FOR WATER UTILITIES

Cost allocation is an inexact but essential part of ratemaking for public utilities. Put simply, it involves the disaggregation of costs according to functions or services to which they can be attributed. Costs are allocated to the extent the analyst is able to attribute causality. The rate structure, then, is typically used to recover costs from those who cause them. Done well, rate structures mean that utilities are able to meet revenue requirements and consumers are sent appropriate pricing signals.

The application of cost-of-service criteria to water utility ratemaking is not a simple task. One significant problem with the cost approach is the subjectivity in cost measurement for specific services and user groups. The degree of subjectivity is a function of the lack of knowledge regarding the cost of specific water services, the costs of supplying specific consumer groups, and the cost of peak versus off-peak consumption. The cost-of-service principle can also generate a conflict between efficiency and simplicity. A rate structure or level based on costs of service may not be publicly acceptable and may not be easy to administer. Given the many participants (for example, city administrators, utility managers, customer groups, special users, bondholders, stockholders, and regulators) who can influence utility ratemaking, it is easy to understand why water ratemaking incorporates noncost elements. A wide variation in rates across water systems in the United States can generally be observed even within categories of the same size, ownership, and source of supply.[1]

It is readily acknowledged, then, that cost-of-service studies cannot provide definitive results since they unavoidably involve analyst judgment and other considerations. Yet there is an underlying presumption that utility rates should correspond to costs and that even rough methods for accomplishing this goal are better than methods that make no attempt to do so. This chapter describes the steps used in cost allocation, with an emphasis on the fully allocated (also referred

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[1] Patrick C. Mann, "The Water Industry: Economic and Policy Issues," in Charles F. Phillips, ed., *Regulation, Competition and Deregulation--An Economic Grab Bag* (Lexington, VA: Washington and Lee University, 1979), 105-6.

signals regarding the resources used in water production; therefore, they will tend to consume either too little or too much water. Conservation is incorporated into the economic efficiency concept but economists generally do not view decreasing consumption in itself as a meaningful goal. That is, conservation is not decreasing usage per se, but instead involves the operation cost and capacity savings from efficient (marginal-cost) pricing.

Water rates based on marginal cost provide the foundation both for attaining an efficient utilization of water system capacity and attaining efficiency in capacity investment. Marginal-cost prices send signals to consumers about the resource cost consequences of their consumption decisions and, conversely, reflect the cost savings if consumers forego the consumption of additional units of water service. The ultimate purpose of marginal-cost pricing is to provide correct price signals for consumption decisions. Thus, when consumers affect water system costs by altering their consumption patterns, their bills change accordingly. In brief, marginal-cost prices reflect the immediate and near-term future cost consequences of usage decisions rather than the historical cost consequences of consumption decisions. Since pricing affects future usage decisions, not past usage decisions, future costs are those relevant for pricing.

In simple terms, economic efficiency is a standard which signals that no further reallocation of resources (either to or from the provision of water service) would enhance consumer satisfaction. The price equal to marginal-cost equation is the best available measure of attaining this standard. For example, price is the best proxy for the value placed on additional units of water service; marginal cost is the best proxy for the value placed on additional units of alternative goods. By water prices reflecting the immediate and near-term future costs of resources used or saved in water consumption, the marginal-cost approach implies a concept of equity in which consumers pay for these costs. In contrast, water prices based on average historical costs create the illusion that resources that can be used or saved at present or in the near-term future cost as much or as little as in the past. The approach implies a concept of equity in which consumers pay for the past costs of consumption decisions.

There are numerous ways of conceptualizing marginal costs: avoidable costs, product-specific costs, single and multiproduct costs, total service incremental

CHAPTER 5

RATE DESIGN FOR WATER UTILITIES

As already mentioned, the theoretical pricing ideal is to set rates equal to the cost of service; in other words, water prices should track water provision costs. However, a perfect match of water utility costs and water rates is not attainable. Noncost influences on rates include politics, past customs and practices, public (consumer) acceptance, adjacent community rates, and (in the case of publicly owned systems) the existing degree or extent of subsidization, taxation, and free service. An example of multiple objectives in designing water rates is the use of a rate structure combining increasing-block rates for residential service (to promote conservation) and decreasing-block rates for commercial and industrial service (to promote economic development). As water prices are increasingly affected by more stringent drinking water regulations, the policy objective of affordability may emerge, for example, in an increasing interest in lifeline rates.

There is a strong tradition in utility regulation that the fairness of rate differentials depends on differences in costs. However, to maintain this tradition these cost differentials must be defined or specified within reasonable limits. For example, cost differentials must be shown to exist to justify decreasing-block rates. If it cannot be established that there are marked differences in the cost of providing different volumes of water service, it would be appropriate to adopt a uniform rate even if this strategy does not track water supply costs with precision.

A recent survey commissioned by the U. S. Environmental Protection Agency provides a general overview of water rate structures according to utility ownership, as reported in table 5-1.[1] In the aggregate, many systems have rates that vary with the amount of water use. However, a significant proportion of systems use flat fees for water service. According to this source, few systems impose only a uniform rate (where the price per unit is constant as consumption increases) or a nonwater use measure (where charges are tied to something other than direct water use). The data are least specific about rate structures for ancillary systems,

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[1] Frederick W. Immerman, *Final Descriptive Summary: 1986 Survey of Community Water Systems* (Washington, DC: Office of Drinking Water, U.S. Environmental Protection Agency, 1987).

EXHIBIT NO. 133

WITNESS: JANICE A. BEECHER, PH.D.

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Application for rate increase by

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COST ALLOCATION AND RATE DESIGN FOR WATER UTILITIES

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COST ALLOCATION AND RATE DESIGN FOR WATER UTILITIES

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EXECUTIVE SUMMARY

Cost allocation and rate design are fundamental and closely related parts of the utility ratemaking process. Their many complexities raise a variety of theoretical and practical issues. Though not a practitioner's manual, this report lays a foundation for further exploration of cost allocation and rate design for water utilities at a time when these concerns are increasingly salient. While the report focuses generally on commission-regulated water utilities, it has wider applicability.

The public water supply sector today is operating in an environment of dramatic change. Increasing public concern about economic growth and drinking water quality have complicated the provision of public water service. Per-capita water usage has continued to increase with rising affluence and urbanization. Potential reservoir sites for surface sources and available ground sources have become more scarce. Federal and state legislation and regulations have resulted in more stringent water quality standards. Traditional solutions to supply problems focused on augmenting existing supply sources; however, nontraditional methods including conservation, recycling, and programs designed to improve water system efficiency (for example, least-cost planning and incentive regulation) are now under consideration.

In the current environment of change, water utility issues are attaining a more prominent place on the public and governmental agendas. This growing interest can be attributed to health concerns, occasional droughts, and increased water rates, the latter being a chief concern of public utility regulators. Rising costs in water supply are the result of more stringent drinking water standards and the need to install costly treatment technologies, capacity additions required to accommodate demand growth, and the replacement and upgrading of aging water system infrastructures. The potential for water rates to rival those for energy utilities has increased regulatory concern, particularly with regard to the problem of rate shock and consumers' continued willingness and ability to pay for water service. Water utilities and regulators alike may need to reconsider cost allocation and rate design alternatives when responding to these issues.

Cost allocation is inexact; no single correct approach or method exists. Much depends on the criteria used by analysts. All cost studies involve judgments and should be viewed as a starting point. The choice of a cost allocation approach depends largely on utility management objectives and regulatory policy considerations. In the context of increasing pressure on water rates, a comparison of fully allocated (also known as fully distributed or embedded) cost analysis and marginal-cost analysis is warranted. Fully allocated and marginal-cost calculations both can provide decisionmakers with useful benchmarks for ratemaking as well as planning. These methods can produce divergent results. As a method of compromise, fully allocated costs can be used to determine revenue requirements while marginal costs can be used to design rates. Incremental least-cost analysis is proposed in this report as a marginal-cost ratemaking approach that emphasizes the practical application of least-cost planning criteria to ratemaking.

The theoretical pricing standard is to set rates equal to the cost of service; that is, rate differentials are based on cost differentials. However, to maintain this standard, cost differentials must be sufficiently defined. For example, if there are no marked differences in the cost of providing different volumes of service, it may be more appropriate to adopt a uniform commodity rate than a decreasing-block or increasing-block rate.

Despite the availability of many alternatives, water rate design leaves much discretion to decisionmakers. As in selecting a cost allocation method, the choice of rate design involves tradeoffs among the goals of efficiency, equity, revenue adequacy, and administrative feasibility. Rates that are equitable may not be efficient or perceived as affordable; rates that are perceived as affordable may not be efficient or generate sufficient revenues; rates that are efficient may not be administratively practical. The inclination to promote economic development or conservation policies through rate design must be considered within the context of basic ratemaking objectives and the tradeoffs among them. Decisionmakers may find it increasingly difficult to balance the competing perspectives that are inherent in the ratemaking process.

Finally, it is important to recognize that improved costing and pricing of water utility service, though essential to economic efficiency, is not a panacea for all the problems confronting water utilities and their regulators. Other issues and solutions merit further study as well.

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FOREWORD

A decade ago, Professor Patrick C. Mann of West Virginia University authored *Water Service: Regulation and Rate Reform,* the Institute's first publication on the subject. These issues are revisited and expanded upon in this report, which also is the Institute's first product funded in part by a grant from the American Water Works Association Research Foundation.

Douglas N. Jones
Director
Columbus, Ohio
December 15, 1990

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CHAPTER 1

INTRODUCTION

Cost allocation and rate design for water utilities are comparatively new areas of inquiry. Historically, water supply economics has focused on the benefits and costs of large-scale water supply projects, such as reservoirs and dams, while often circumventing issues of cost and price in the public water supply sector.[1] In the public utility realm, the greater attention to other utility services (such as electricity and natural gas) can be attributed to several factors, including the relatively static nature of water industry technology, the relatively small size of the water industry within the United States economy, the dominance of water quality and quantity issues over economic and financial concerns, and the limited debate over issues such as public versus private provision of water service and the appropriate role of competition.[2] A case in point is that geographically localized water shortages tend to heighten awareness of the need to ensure long-term water supplies. However, the predominant response has been to appeal for conservation through voluntary and sometimes mandatory rationing rather than through pricing reform.[3]

One of the more important reasons for the eclipse of water supply by other utility sectors is that in the past, water service has been supplied at a lower cost than other utility services and has generally constituted a relatively small proportion of residential consumer budgets and business expenditures. The relative abundance of inexpensive water supplies has helped keep water prices low. In addition, water rates have generally been increasing at a slower rate than prices for other public utility services. However, low water rates for many publicly owned and privately owned water utilities in the United

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1 These points are made in Patrick C. Mann, *Water Service: Regulation and Rate Reform* (Columbus, OH: The National Regulatory Research Institute, 1981).

2 Jerome W. Milliman, "Policy Horizons for Future Urban Water Supply," *Land Economics* 39 (May 1963): 109-32.

3 According to the economic paradigm, pricing is the preferred rationing and allocation tool.

States can be explained in part by underpricing.[4] The consequences of underpricing include deferring system maintenance and postponing capital replacement of obsolete or aging system facilities.

Underpricing of water service is a function of the need for more refined cost-of-service standards, the use of historical accounting costs (rather than present or near-term future costs) in the ratemaking process, the use of average embedded (rather than incremental) cost as the primary pricing standard in the context of increasing real unit costs of water provision, inadequate provisions for depreciation, maintenance, and other expenses, and consumer pressure to keep rates low. Another explanation for underpricing by some municipal water systems is the political nature of ratemaking at the local level. Although structured differently, many state regulated and privately owned water utilities suffer from many of the same problems. The lack of uniformity in water pricing in general can be partly attributed to the ownership and regulatory dichotomy between public and private water providers.

Forces of change are emerging.[5] In the early 1990s, water issues in general appear to be moving higher on the public and governmental agendas. Issues of economic growth and environmental quality have greatly complicated the provision of water service. Per-capita water usage has continued to increase with rising affluence and urbanization. Potential reservoir sites for surface sources have become more scarce while ground sources have become of limited availability. The traditional solution to supply problems has been to expand or augment supplies; however, nontraditional methods such as conservation, recycling, and programs designed to improve system efficiency (for example, least-cost planning and incentive regulation) are at present under serious consideration. The numerous forces affecting all utilities and their regulation have begun to affect water supply.

Although water quality and quantity issues continue to be prominent, increasing attention is being paid to rising water utility costs, which are primarily related to safe drinking water regulations and the need to install

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[4] On this issues, see James Goldstein, "Full-Cost Water Pricing," *American Water Works Association Journal* 78 no. 2 (February 1986): 52-61.

[5] Patrick C. Mann, "Reform in Costing and Pricing Water," *American Water Works Association Journal* 79 no. 3 (March 1987): 43-45.

costly new treatment technologies, additions to capacity to accommodate growth, and replacement and upgrading of aging infrastructure. Secondary factors include rising energy costs and inflation. Today, the potential for substantial water rate increases and accompanying rate shock looms large, rivaling the past experience of the nation's energy utilities. Changes in pricing policies to encourage conservation and the wise use of water may add to the upward pressure on water rates. As rates rise, so does concern about consumer willingness and ability to pay for water service. All of these issues place demands on water supply managers and regulators as they evaluate cost allocation and rate design alternatives.

Cost allocation and rate design are distinct but intrinsically related processes. The usual purpose of analyzing costs is to provide a basis for setting rates. Likewise, contemporary rate design emphasizes the determination of *cost-based* rates; indeed this objective has become fundamental to utility ratemaking. This report provides essentially a status report on cost allocation and rate design for water utilities. It draws upon theoretical as well as practical knowledge about these topics and provides a basis for evaluating some of the available alternatives. While the focus is mainly on privately owned and state regulated water utilities, the study has broader applicability to other water service providers, all of whom are confronted with cost allocation and rate design issues.

This chapter provides an overview of the issues of value, cost, and price, and a framework for the remainder of the analysis. Chapter 2 provides a description of the water supply industry. Chapter 3 reviews cost allocation, focusing on the embedded cost approach, while chapter 4 reviews conceptual and application issues related to marginal (incremental) cost pricing. Chapter 5 turns to issues of rate design. Chapter 6 offers concluding remarks and is followed by a series of technical appendices, including a glossary of terms and a bibliography. Though not a practitioner's manual, this report lays a foundation for further exploration of cost allocation and rate design for water utilities at a time when these concerns are increasingly salient.

Value, Cost, and Price[6]

Value, cost, and price are intrinsically related and highly interdependent concepts. Although understanding each concept greatly helps in understanding the others, they are distinct in that each evokes a different set of considerations in the water supply field.

Water is a value-added commodity. Its value raises issues of scarcity, competition, and the need for integrated water resource planning. An increasing awareness of water's value has led some to adopt a wise-use approach to its consumption, including--but not limited to--conservation. The cost of supplying water is increasing, especially the expense of complying with safe drinking water regulations. Cost issues also raise questions related to economies of scale and the structural character of the water supply industry. Finally, pricing deals with sending appropriate signals to customers about the value and cost of water. Value-of-service and cost-of-service pricing are contrasting (but not necessarily incompatible) approaches. In the regulatory context, pricing is a part of the process by which revenue requirements are determined, costs allocated, and tariffs designed.

The Value of Water

Of the approximately 340 billion gallons of water withdrawn daily in the United States from surface and ground sources, only about 11 percent is used by public water suppliers. Public suppliers "compete" for water withdrawals mainly against water use in agriculture and electricity generation. The value of water used by public utilities is somewhat dependent on the value society places on other water uses. Over the past several decades, competition for water has intensified greatly, partly because some water sources have reached their carrying capacities or have become impaired either by natural or manmade causes.

Globally, water in its natural state is abundant and renewable, but remains finite and nonrenewable in some respects. For instance, water is nonrenewable when it comes from a severely depleted or contaminated groundwater source. Water

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6 See Janice A. Beecher, "Value, Cost, and Price: Essay on Emerging Water Utility Issues," *NRRI Quarterly Bulletin* 11 no. 2 (June 1990): 177-181.

costly new treatment technologies, additions to capacity to accommodate growth, and replacement and upgrading of aging infrastructure. Secondary factors include rising energy costs and inflation. Today, the potential for substantial

withdrawals also require the expenditure of nonrenewable and usually expensive energy resources.

For water users of any type, the cost of water itself (the unprocessed variety) is negligible. All water used by human beings has value principally because its natural characteristics have been altered through withdrawal, transportation, treatment, and/or distribution. Water is a good example of a "value-added" commodity. Indeed, water utilities are in the business of adding value to water, particularly when it comes to safe drinking water.

Several books and articles in recent years have used the terms "scarcity" and "crisis" with respect to water.[7] With globally abundant supplies, it is hard for many to believe that water shortages are a relevant concern. Economists, in fact, prefer the more neutral terminology of supply and demand rather than the concept of scarcity. A "shortage," then, is manifested in higher prices for limited supplies of a good. Higher prices may cause usage to subside, lead to a reallocation of existing supplies in the short term, and stimulate the production of more supplies in the long term.

Because water is vital to human life and because it is not always where we need it when we need it, concerns about scarcity are very real. The North American continental drought of 1988 fueled fears about water shortages in much the same way that the energy crisis of the 1970s dramatized the prospect of energy shortages. In particular, we know more today about the importance of adequate drought planning than before 1988. It may be a well-known truism, but water shortages are not caused by nature but instead are caused by people.

The issue of water scarcity has contributed to an emerging philosophy known as the "wise use of water." Wise use emphasizes, above all else, reducing the wasteful use of water. It is applicable to all types of water (such as treated and untreated water) and all types of water users (such as irrigators, hydroelectric power producers, public suppliers, and consumers). Wise use can take the form of better supply management (such as leak detection and repair) and better demand management (such as pricing reform). Implementing wise-use strategies should be a prerequisite to any large-scale investment in new water supplies, and certainly to any serious consideration of constructing a multi-billion-dollar intercontinental canal

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[7] See Janice A. Beecher and Ann P. Laubach, *Compendium on Water Supply, Drought and Conservation* (Columbus, OH: The National Regulatory Research Institute, 1989).

system, as has been proposed. Pricing, along with integrated resource planning and other policy approaches, is an integral part of most allocation solutions associated with this essential value-added commodity.

The Cost of Water

Perceptions about water's value clearly are enhanced when it costs more. The cost of water is a function both of quality and quantity (that is, availability). Water that is safe to drink tends to cost more. So does water from sources difficult to secure.

Without doubt, the greatest pressure today on the cost of water in the United States is the implementation of the 1986 amendments to the Safe Drinking Water Act (SDWA). Nationally, implementation of the SDWA before the turn of the century may require $30 to $40 billion in capital expenditures alone.[8] Added operation and maintenance costs (including those related to the disposal of contaminants) may substantially increase the total cost of compliance with the act. For individual utilities, the cost of complying with these regulations (both capital and operating) is estimated to be as high as $2,062 per revenue-producing million gallons (RPMG).[9]

SDWA compliance costs for public water suppliers vary across systems as a function of site-specific factors, including system size and, of course, type of treatment required. Smaller systems--and their customers--will be hardest hit by the new regulations. However, because the very smallest systems have a chance for exemption from SDWA requirements (at least in the short term) and because large systems tend to benefit from economies of scale, medium-sized water utilities may be the first to feel the effect of SDWA compliance and thus the first to seek recovery of those costs.

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8 James P. McFarland, John E. Cromwell, Elizabeth L. Tam, and David W. Schnare, "Assessment of the Total National Cost of Implementing the 1986 SDWA Amendments," a paper presented at the NRRI Biennial Regulatory Information Conference in Columbus, Ohio (September 1990).

9 Patrick C. Mann and Janice A. Beecher, *Cost Impact of the Safe Drinking Water Act on Commission Regulated Water Utilities* (Columbus, OH: The National Regulatory Research Institute, 1989).

Because of economies of scale in water supply, there is a growing interest in structural options for water utilities (such as regionalization, mergers, and acquisitions) particularly when very small systems can be absorbed by larger ones that are more financially viable. There is also a growing interest in "nonproliferation" of small systems, that is, in preventing these very small (and often eventually troubled) systems from coming into existence in the first place.

For water utilities that fall under the jurisdiction of regulators, cost recovery is closely related to the issue of management prudence. Regulators will want assurances that least-cost alternatives are being pursued, including improvements both to supply and demand management. Keeping costs down may emerge as the first priority of water suppliers and their regulators. On the other hand, for consumers to value water service accurately, they must realize its true economic costs. This raises the issue of price.

The Price of Water

Prices that accurately reflect costs send correct signals to consumers about the value and cost of water, and thereby encourage wise use and discourage wasteful consumption. Nevertheless, prices in many areas may not adequately reflect the cost of providing water service. Further, the absence of metering, the use of rates unrelated to usage, and subsidization to or from nonutility functions are especially problematic. So is the use of embedded accounting costs in setting rates. Many contemporary pricing strategies are based on the idea of marginal cost, which is the additional cost of producing or selling a single incremental unit.[10] Not everyone agrees with marginal-cost pricing and (not surprisingly) the biggest difficulty in applying it is estimating marginal costs, which depend on assumptions about when the next increment of supply will be added, where it will come from, and how much it will cost. Marginal-cost estimation requires detailed and accurate cost data as well as extra effort on the part of water suppliers and their regulators. For small utilities, it may be a highly impractical approach.

Setting prices also entails assessing the potential effect of a change in price on consumption. The conservation of centrally supplied water through pricing is

10 See Patrick C. Mann, and Donald L. Schlenger, "Marginal Cost and Seasonal Pricing of Water Service," *American Water Works Association Journal* 74 no. 1 (January 1982): 6-11.

largely a function of the price elasticity of water demand, which is somewhat variable. Outdoor use, for example, is more price-elastic than indoor use. Some water rate structures--such as increasing block and seasonal rates--are specifically designed for conservation purposes, although disagreement exists over their use. As the cost of water treatment increases, greater attention must be paid to the issue of rate design and alternative rate structures, such as seasonal pricing. It also may be necessary to reconcile value-based and cost-based pricing through less conventional rate structures, such as scarcity pricing or excess-use charges.

Finally, one potential result of higher costs for water treatment is rate shock, especially for consumers served by utilities whose rates are currently very low.[11] Water suppliers and regulators may need to look for ways to mitigate rate shock, including rate phase-in plans similar to those that have been applied to nuclear plants in the electricity sector.[12] For any pricing scheme, however, the effects on utility investors in the regulatory context must be examined.

For a water supplier, generating revenues may be the primary consideration. For the ratepayer, the critical issue is price. As prices rise, some customers will seek substitutes, such as bottled water and reliance on their own wells. Others will seek technological solutions--recycling and low-use devices. Still others simply will change their water use habits. In the worst case, some may be unable to afford water that is safe to drink. Policymakers then will have to deal with the implications of such cases. If higher prices accurately reflect water service cost, however, many customer complaints will be difficult to resolve.

Pricing and resource conservation are inseparable issues because of the relationships of price to quantity demanded. From the viewpoint of economic theory, price is essential to the appropriate valuation, consumption, and conservation of resources. Without correct price signals, consumers may overconsume or underconsume water. Historically, weak price signals characterized by low water prices may be associated with too little conservation. In the future, that situation is likely to change.

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11 See Mann and Beecher, *Cost Impact*.

12 Another view is that rate shock is necessary and even desirable for sending accurate pricing signals that lead to changes in consumption behavior. In this view, the effects of rate increases should not be mitigated through phase-in plans or other measures.

The philosopher David Hume once asserted that if all goods were free, as are air and water, anyone could get as much as he wanted without harming others.[13] Today, we know that breathable air and drinkable water are not free. Indeed, they are precious resources that must be protected with diligence, allocated with considerable care, and used wisely. Water has intrinsic value because it is life sustaining. Public water utilities add substantial value by extracting water from its source, carrying it over long distances, and delivering it to our homes ready for safe consumption. The cost of doing so is not insignificant. As the price of water service increases, consumers will appreciate its real cost more than ever before.

The Ratemaking Process

Whether regulated or unregulated, all public utilities charge rates for the services they provide. Rates charged by most publicly owned utilities are determined by governing boards or local authorities. Rates charged by most investor-owned utilities are determined by state regulatory commissions. Water utilities, consumers, and society as a whole have different perspectives on ratemaking, as summarized in table 1-1. These perspectives apply not only to utility rates, but also to the process from which rates emerge.

Three Perspectives on Ratemaking

Utilities expect to be fully compensated for the cost of providing service; that is, revenue requirements must be met. Revenues to the utility must be sufficient to cover capital and operating expenses. Investor-owned utilities also want rates to incorporate a reasonable return on their capital investment. Similarly, publicly owned utilities want to be financially self-sufficient, and not rely on subsidization from other revenue sources. From the utility's perspective, ratemaking is also strategic with regard to the ability to provide its service using existing capacity as well as plan for future additions to capacity. Predictable revenues and flexible rate

13 As quoted in William Ophuls, *Ecology and the Politics of Scarcity* (San Francisco: W. H. Freeman and Company, 1977), 8.

TABLE 1-1

THREE PERSPECTIVES ON RATEMAKING

Utility's Perspective

- Does the rate structure fully compensate the utility so that revenue requirements are met?
- Does the rate structure allow the utility to earn a fair return on its investment?
- Is the rate structure strategically sound for load management, competition, and long-term planning?

Consumer's Perspective

- Are both the ratemaking process and the rate structure equitable?
- Are utility rates perceived to be affordable?
- Are both the ratemaking process and the rate structure understandable?

Society's Perspective

- Does the rate structure promote economic efficiency?
- Does the rate structure promote the appropriate valuation and conservation of resources?
- Does the ratemaking process take into account priority uses of water?
- Are both the ratemaking process and the rate structure just and reasonable?

Source: Authors' construct.

The philosopher David Hume

structures are strategically advantageous to the public utility, particularly if the utility faces any form of competition, including bypass and self supply.

For consumers, the ratemaking process and resultant rates should be equitable or fair to all types of consumers. This usually means that charges to specific types or classes of customers should be based on the costs of serving those customers, and not on arbitrary or discriminatory criteria. Consumers also prefer rates they perceive to be affordable, which is becoming an increasingly difficult expectation to meet. They also fare better with a rate structure that is understandable, which presumably improves consumption decisions. Consumer understanding and acceptance of utility rates make the job of ratemaking much easier.

Society's perspective differs from that of utilities or consumers. Economic or allocative efficiency is a societal goal having to do with costing and pricing. Rates based on efficiency goals encourage appropriate levels of production and consumption and discourage the misallocation of societal resources. Efficiency also dictates rates that are not unduly discriminatory from an economic standpoint.[14] In the context of efficiency, society has an interest in conserving (that is, not wasting) resources. Conservation emphasizes the correct valuation and allocation of resources. Ratemaking can send signals about priorities. Society may place a priority, for example, on water for human consumption over water for agricultural or industrial uses, and this may be reflected in pricing schemes in the form of subsidization. Finally, society may judge ratemaking in terms of whether it is just and reasonable, a time-honored standard in utility regulation. Good intentions can result in unjust or unreasonable outcomes, as when the cost of regulation itself outweighs its benefits. Many ratemaking practices exist that are accepted as reasonable from the societal standpoint. Creating customer classes and employing averaging to allocate cost among them, for example, may be a form of price discrimination considered reasonable on the basis of regulatory cost savings.

Ratemaking is a continual balancing act among the divergent and often competing perspectives of utilities, consumers, and society. Rates that are perceived by consumers to be affordable do not necessarily meet revenue requirements; rates that are equitable are not necessarily efficient; rates that are

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[14] See J. Stephen Henderson and Robert E. Burns, *An Economic and Legal Analysis of Undue Price Discrimination* (Columbus, OH: The National Regulatory Research Institute, 1989).

economically efficient are not necessarily administratively feasible because of practical application issues.

In balancing perspectives, the key objectives of rate regulation emerge. Although there are many different conceptualizations, the objectives identified tend to be similar. Bonbright, Danielson, and Kamerschen emphasize capital attraction (the utility perspective), fairness to ratepayers (the consumer perspective), and rationing (the societal perspective) as regulation's principal objectives.[15] Their assessment also includes what is referred to as the "ten attributes of a sound rate structure," reported in table 1-2. These attributes can be used to evaluate rate structures as well as the methodologies used to design them. As the authors explain, "Lists of this nature are useful in reminding the ratemaker of considerations that might otherwise be neglected, and also useful in suggesting important reasons why problems of practical rate design do not yield readily to scientific principles of optimum pricing."[16]

Decision Areas in Cost Allocation and Rate Design

Cost allocation and rate design can be dissected into several distinct (though highly interrelated) decision areas, each of which can be further dissected into principal considerations, as identified in table 1-3. The first is the identification of the utility's revenue requirement, which is a function of its capital investment (rate base), allowed rate of return, operation and maintenance expenses, depreciation, and taxes.[17] Costs next can be divided into functional categories of water supply, such as source development, pumping, transmission, treatment, storage, and distribution. Functional cost categories can also be established for nontraditional sources of capacity (such as leak detection and repair, purchased water, or conservation). The next step is to classify costs in terms of customer, capacity (demand), and commodity (operating) costs, distinctions which also are used in rate design. Many methods also emphasize the separate classification of fire protection costs.

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[15] James C. Bonbright, Albert L. Danielsen, and David R. Kamerschen, *Principles of Public Utility Rates* (Arlington, VA: Public Utilities Reports, 1988), 382-84.

[16] Ibid., 384.

[17] See chapter 4.

TABLE 1-2

ATTRIBUTES OF A SOUND RATE STRUCTURE

Revenue-related Attributes

1. Effectiveness in yielding total revenue requirements under the fair-return standard without any socially undesirable expansion of the rate base or socially undesirable level of product quality and safety.
2. Revenue stability and predictability, with a minimum of unexpected changes seriously adverse to utility companies.
3. Stability and predictability of the rates themselves, with a minimum of unexpected changes seriously adverse to ratepayers and with a sense of historical continuity.

Cost-related Attributes

4. Static efficiency of the rate classes and rate blocks in discouraging wasteful use of service while promoting all justified types and amounts of use:
   (a) in the control of the total amounts of service supplied by the company;
   (b) in the control of the relative uses of alternative types of service by ratepayers (on-peak versus off-peak service or higher quality versus lower quality service).
5. Reflection of all of the present and future private and social costs and benefits occasioned by a service's provision (i.e., all internalities and externalities).
6. Fairness of the specific rates in the apportionment of total costs of service among the different ratepayers so as to avoid arbitrariness and capriciousness and to attain equity in three dimensions: (1) *horizontal* (i.e., equals treated equally); (2) *vertical* (i.e., unequals treated unequally); and (3) *anonymous* (i.e., no ratepayer's demands can be diverted away uneconomically from an incumbent by a potential entrant).
7. Avoidance of undue discrimination in rate relationships so as to be, if possible, compensatory (i.e., subsidy free with no intercustomer burdens).
8. Dynamic efficiency in promoting innovation and responding economically to changing demand and supply patterns.

Practical-related Attributes

9. The related, practical attributes of simplicity, certainty, convenience of payment, economy in collection, understand-ability, public acceptability, and feasibility of application.
10. Freedom from controversies as to proper interpretation.

Source: James C. Bonbright, Albert L. Danielsen, and David R. Kamerschen, *Principles of Public Utility Rates* (Arlington, VA: Public Utilities Reports, 1988), 382-84.

TABLE 1-3

COST ALLOCATION AND RATE DESIGN FOR WATER UTILITIES: DECISION AREAS AND PRINCIPAL CONSIDERATIONS

Decision Areas	Principal Considerations
Identification of Revenue Requirement	Capital investments/rate base Return on rate base Operation and maintenance expenses Depreciation Taxes
Cost Functionalization	Source development Pumping Transmission Treatment Storage Distribution Nontraditional supply
Cost Classification	Customer costs Capacity (demand) costs Commodity (operating) costs
Cost Allocation	Functional cost Commodity demand Base-extra capacity Embedded direct Fully distributed Marginal/incremental
Cost Assignment	Residential Commercial Industrial Wholesale Institutional Public authorities Fire protection

TABLE 1-3 (continued)

Decision Areas	Principal Considerations
Rate Design	Flat fees Fixture rates Uniform rates Decreasing block pricing Increasing block pricing Seasonal rates Excess use charges Indoor/outdoor rates Lifeline rates Sliding scale pricing Scarcity pricing Spatial pricing
Tariff Design	Customer charges Capacity (demand) charges Commodity (operating) charges Dedicated-capacity charges Capital contributions Fire protection charges Ancillary charges

Source: Authors' construct.

The analyst then chooses a cost allocation method for attributing costs to their respectives causes. Some of the methods used are functional cost, commodity demand, base-extra capacity, embedded direct, fully distributed, and marginal (or incremental). Next is the assignment of costs to classes of service. Some typical service classes in water supply are residential, commercial, industrial, wholesale, institutional, public authorities, and fire protection. Finally, rates for each customer class presumably based on the cost of serving them are established. There are many potential water rate structures, some of which appear in table 1-3. The resulting tariff, or authorized list of water service charges, may consist of customer, capacity, and commodity charges as well as special charges for dedicated capacity, capital contributions, fire protection, and ancillary services. Some charges (such as customer charges) are fixed, meaning they do not vary with water usage; others (such as commodity charges) are variable, meaning they do vary with water usage.

The decision areas in cost allocation and rate design are distinct but overlap considerably. Decisions about costs may affect the choice of methodology; decisions about customer classes may affect the choice of a rate structure. The resulting rates should allow the utility to meet its revenue requirements. There are also many subtle and not-so-subtle issues that emerge in the course of ratemaking that require an analyst's judgment. Because there is no such thing as a typical water utility, there may be few precedents or rules of thumb on which to rely. In practice, convenience, expedience, and tradition probably affect ratemaking for water utilities as much as economic analysis.

Generally, the cost-of-service standard has prevailed in setting water rates. This means setting rates that generate revenues from each user group equal to the cost of serving that group. That is, the user class that causes the expense absorbs the cost in rates paid for water service. The cost-of-service concept implies equal treatment for users with equal costs and rate differentials reflecting cost differences. This presumes, however, that water service costs are easily ascertainable for specific user groups. In many cases, cost-of-service analyses ignore the distinction between average (unit) costs and marginal (incremental) costs, between short-run and long-run costs, and between peak and off-peak costs of services. Water rates, as with other public utility rates, are based on averaging (that is, the average users having an average load factor); price discrimination is inherent.

Although cost-based, water utility ratemaking generally has not made use of sophisticated cost allocation methodologies (to identify cost causers) and rate design alternatives (to assign costs to customers).[18] Limited regulatory resources are the leading explanation for why this is so. Moreover, water rates have been affected by other factors, such as political considerations, tradition, value of service, and legal constraints. For example, many water rates have been adopted on the basis of either minimal customer complaint or consistency with the rates of adjacent communities. In brief, setting water rates involves a combination of analysis and expedience as well as a desire to balance competing policy goals. However, in the increasingly complex realm of water utility ratemaking, particularly in light of rising costs and prices, these issues are worth exploring.

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18 There are exceptions. Articles appearing in the *American Water Works Association Journal* are a good source on new approaches.

CHAPTER 2

CHARACTERISTICS OF WATER UTILITIES

The water supply industry is both "mature and conservative."[1] Its maturity accounts for a relatively low rate of technological innovation. As a consequence, few radical changes have occurred in the methods of delivering drinking water by central suppliers over the past few decades. The rate of technological change may be stimulated by the stringent drinking water regulations promulgated by the U.S. Environmental Protection Agency under the amended Safe Drinking Water Act and administered by the states through environmental or public health agencies. Increased water prices may also bring about technological, structural, managerial, and regulatory changes. However, there persists a tendency for water supply planners to rely on proven facility designs and standard operating procedures. Thus, the industry's operating characteristics remain relatively constant.

The Water Service Industry

The U.S. Environmental Protection Agency (EPA) estimates that there are more than 50,000 water systems in the United States, as reported in table 2-1. All community water systems must comply with safe drinking water regulations set by the EPA and administered through state agencies. About half of the systems are owned by governmental entities, usually municipalities. The rest are nearly equally divided between privately owned systems and ancillary systems (such as those found in mobile home parks).

Water utilities are somewhat distinct from other types of public utilities in that many small systems serve a relatively small (but not insignificant) portion of the United States' population, as seen in table 2-2. Most of these small systems serve fewer than five hundred persons each. The financial and operating characteristics of water systems vary substantially according to system size. Small water systems are generally defined by the U.S. Environmental Protection Agency as those serving fewer than 3,300 people (approximately 1,000 connections). The

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[1] Wade Miller Associates, *The Nation's Public Works: Report on Water Supply* (Washington, DC: National Council on Public Works Improvement, 1987), 22-24.

TABLE 2-1

WATER SYSTEMS IN THE UNITED STATES, 1986

Ownership Structure*	Number of Utilities	Percent of All Systems
Public		
Local, municipal government	23,248	44.3%
Federal government	528	1.0
On Indian land	127	.2
Subtotal	23,903	45.5
Private		
Investor-owned		
Financially independent	6,716	12.8
Financially dependent on parent company	986	1.9
Homeowners' association or subdivision	6,163	11.7
Other	661	1.3
Not available	178	.3
Subtotal	14,703	28.0
Ancillary		
Mobile home parks	10,150	19.3
Institutions	535	1.0
Schools	458	.9
Hospitals	91	.2
Other	2,638	5.0
Not available	31	.1
Subtotal	13,903	26.5
Total	52,509	100.0%

Source: Frederick W. Immerman, *Financial Descriptive Summary: 1986 Survey of Community Water Systems* (Washington, DC: Office of Drinking Water, U.S. Environmental Protection Agency, 1987), table 2-2.

* This table is organized according to ownership, without regard to whether different types of systems are regulated by state public utility commissions.

TABLE 2-2

WATER SYSTEMS IN THE UNITED STATES
BY OWNERSHIP STRUCTURE AND POPULATION CATEGORY, 1986

Community Size (persons)	Number of Systems: Public (a)	Private (b)	Ancillary (c)	Total	Average Daily Production: Percent	MGD(d)
25-100	1,525	4,544	8,264	14,333	27.2	.025
101-500	5,416	5,129	4,743	15,288	29.1	.057
501-1,000	3,777	1,655	600	6,032	11.5	.623
1,101-3,300	5,831	1,933	286	8,050	15.3	.714
3,301-10,000	3,950	904	5	4,860	9.2	1.240
10,001-25,000	1,828	237	5	2,070	3.9	4.240
25,001-50,000	897	158	0	1,055	2.0	9.911
50,001-75,000	227	38	0	265	0.5	10.150
75,001-100,000	145	22	0	167	0.3	10.472
100,001-500,000	261	52	0	313	0.6	36.593
500,001-1,000,000	33	29	0	62	0.1	104.422
Over 1,000,000	13	1	0	14	0.03	442.197
Total	23,903	14,703	13,903	52,509	-	-
Percent	45.5%	28.0%	26.5%	100%	-	-

Source: Frederick W. Immerman, *Financial Descriptive Summary: 1986 Survey of Community Water Systems* (Washington, DC: Office of Drinking Water, U.S. Environmental Protection Agency, 1987), table 2-2 and 3-1.

(a) Local, municipal government, federal government, and on Indian land.
(b) Investor-owned (both financially independent systems and systems financially dependent on parent companies), homeowners' associations or subdivisions, other, and don't know/refused.
(c) Mobile home parks, institutions, schools, hospitals, other, and information not available.
(d) Millions of gallons daily for 1985.

problems of these systems are well documented.[2] Policymakers at the federal and state levels continue to be greatly concerned about the proliferation of new small, nonviable systems as well as the future of existing nonviable systems.

Water systems have many of the characteristics of monopolies. They typically face little or no competition at the operating level because duplicating service would be costly and inefficient. Their product has no substitute, although there are alternative methods of delivery as well as alternative levels of water quality. Perceptions of market failure--for technological, economic or public health reasons--reinforce the provision of water service mainly by publicly owned or regulated privately owned water utilities.

Forty-six state public utility commissions have the authority to regulate water systems in the United States; nearly 10,000 systems fall under this jurisdiction, and about one-half of these are investor-owned. Fifteen commissions have some jurisdiction over publicly owned water systems. Economic regulation by state commissions is aimed at giving monopolistic utility providers an opportunity to earn a "fair return" on their investment through "just and reasonable" rates. In return, regulated utilities must meet certain obligations to serve, which is to say they cannot discriminate in providing service within their franchised territory and must meet standards of quantity, quality, safety, and reliability. In short, a "regulatory compact" exists between the states and their jurisdictional public utilities. It is an imperfect but essential institutional arrangement.

The economic regulation of water utilities has often been subordinate to the regulation of electric, gas, and telecommunications utilities, mainly because the regulated portion of these other utility sectors consists of much larger firms serving more customers and accounting for a much greater share of economic activity as well as consumers' expenditures on utility services. Even so, many commissions report spending a disproportionate amount of resources on oversight of water utilities.

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[2] See Raymond W. Lawton and Vivian Witkind Davis, *Commission Regulation of Small Water Utilities: Some Issues and Solutions* (Columbus, OH: The National Regulatory Research Institute, 1983), 5-6. A forthcoming NRRI report on the nonproliferation of nonviable water systems also will address these issues.

Although deregulating water utilities is sometimes discussed, an economic rationale for such a policy is not readily apparent.[3] Strategies to improve regulatory efficiency and effectiveness, while reducing costs, are more realistic and urgently needed.

A typical water utility does not exist. The smallest systems are substantially different from the largest in practically all respects. However, some general observations about the cost characteristics, financial characteristics, scale and scope economies, demand characteristics, price elasticity of water demand, and water conservation are appropriate to the later analysis of cost allocation and rate design for water utilities.

Cost Characteristics

Selected operating characteristics of water suppliers according to the size of community served are presented in table 2-3. As would be expected, average net assets and average operating revenues are largely a function of water system size. Using the standard of capital investment per revenue dollar, the water utility industry is possibly the most capital intensive of all utility sectors. Using these data, water systems require $7.80 in assets for every dollar of revenue generated; the ratios range from 5.2 to 19.6. One study found that large water systems required as much $10 to $12 in capital for every dollar of revenue generated and compared this to ratios of 1:1 for the airline industry, 2:1 for railroads, 3:1 for telephone companies, and 3-4:1 for electric utilities.[4] Thus, even in the capital-intense public utility sector, water supply has particularly significant capital requirements.

The high capital intensity in water supply is mostly a function of the capital investment necessary for maintaining production capacity, maintaining a complex distribution network that ties the utility system directly to the consumer, and the necessity of meeting both fire protection and peak demands. The capital intensity

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[3] Janice A. Beecher and Patrick C. Mann, *Deregulation and Regulatory Alternatives for Water Utilities* (Columbus, OH: The National Regulatory Research Institute, 1990).

[4] Science Management Engineering and TBS, Inc., *Urban Water System Characterization* (1979), 15, as reported in Wade Miller Associates, *Report on Water Supply.*

problems of these systems are well documented.[2] Policymakers at the federal and state levels continue to be greatly concerned about the proliferation of new small, nonviable systems as well as the future of existing nonviable systems.

TABLE 2-3

SELECTED CHARACTERISTICS OF THE WATER SUPPLY INDUSTRY IN THE UNITED STATES

Community Size (persons)	Average Net Assets ($000) (a)	Average Operating Revenues ($000) (b)	Ratios: Assets/ Revenues (c)	Ratios: Assets/ Water Output (d)	Ratios: Expenses/ Water Output (e)	Ratios: Revenues/ Water Sold (f)
25-100	$490	$25	19.6	$24.9	$278	$198
101-500	426	45	9.5	16.5	259	243
501-1,000	792	103	7.7	8.4	164	184
1,101-3,300	3,193	475	6.7	7.2	164	204
3,301-10,000	3,471	514	6.8	4.6	141	150
10,001-25,000	13,970	1,999	7.0	4.1	139	180
25,001-50,000	15,185	2,795	5.4	2.4	83	114
50,001-75,000	31,721	3,824	8.3	2.2	83	103
75,001-100,000	53,392	8,461	6.3	3.2	108	109
100,001-500,000	98,311	14,861	6.6	2.2	80	115
500,001-1,000,000	206,616	39,971	5.2	2.0	68	113
Over 1,000,000	659,491	108,318	6.1	1.8	51	82
For all systems	$5,784	$745	7.8	$10.5	$188	$196

Source: Frederick W. Immerman, *Financial Descriptive Summary: 1986 Survey of Community Water Systems* (Washington, DC: Office of Drinking Water, U.S. Environmental Protection Agency, 1987), tables 5-1, 4-1, 5-5, 4-9 and 4-5. The data represent publicly-owned and privately-owned water systems.

(a) Current assets, net plant and equipment (gross plant and equipment less accumulated depreciation), and other assets in thousands ($000).
(b) Water operation revenues in thousands ($000).
(c) The ratio of (a) to (b), as calculated by authors.
(d) Gross plant and equipment (before depreciation) divided by average daily production ($/gallons per day).
(e) Operating expenses in cents/1,000 gallons produced.
(f) Water operation revenue (excluding other sources of revenue or municipal fund transfers) in cents/1,000 gallons delivered. Only systems that charge for water are included in the analysis.

is reflected in high capital investment/revenue ratios and low capital turnover rates; that is, low revenue/capital investment ratios.

In examining water utilities, the concepts of variable and fixed costs are relevant. The important classifications are short-term variable costs that change with output supplied (such as treatment chemicals and purchased water), and short-term fixed costs that do not vary with the volume of service (such as depreciation of distribution mains).

The characteristic of high fixed costs relative to variable costs for water utilities has important pricing implications. Conceptually, for reasons of economic efficiency discussed in chapter 3, fixed costs should be incorporated in service or customer charges rather than in commodity (usage) charges. In other words, commodity charges should only include those costs that tend to vary with the volume of services; costs that do not vary with service volume are more appropriately incorporated in service charges, which are at fixed levels. A related costing implication of the high fixed-cost-to-variable-cost ratio for water utilities is that customer load factors can play an important role in rate design. Large users with better load factors can argue that their usage patterns are associated with lower unit costs than lower load factor customers.

Financial Characteristics

The high capital intensity of water supply also has financial implications. Many water utilities have aging capital facilities that need to be replaced during this decade; others must upgrade plant facilities to meet the requirements of the Safe Drinking Water Act. This has forced water utilities to examine options for financing the replacement of aging and/or obsolete facilities. In most cases, the cost of replacement will exceed original costs by a substantial amount.

Investments in water supply tend to be large and indivisible; the "lumpiness" feature that is also typical of other public utility sectors. Many of these investments, including treatment plants and the transmission and distribution infrastructure, may have very long service lives. Because capacity is added in large increments, there may be periods of underutilization (or excess capacity), which can pose significant financial problems in terms of cost recovery. Of course, the utility with plentiful capacity is also in a good financial position to accommodate demand growth.

Because of their small size and weak financial structure, many water systems lack the ability to attract capital through the same mechanisms as larger utilities.[5] Many small water utilities lack a substantial rate base because their original capital costs were recovered through the purchase price of houses in a residential subdivision. Furthermore, the ratemaking process does not consider contributed plant an asset that can placed into rate base (for earning a return) or depreciated (an expense). Without a sufficient rate base, equity, or physical assets to serve as collateral, small water utilities find it difficult and expensive to raise capital. Tales of the very small water utility owner using a home or car for financing collateral are widely circulated. Also, many water systems with ownership of physical plant do not adequately provide for system depreciation, and thus are in a poor position to replace or upgrade infrastructure. The need to make capital improvements to comply with more stringent drinking water standards adds to the financial stress on small water systems.

Some common patterns can be noted in water system financing.[6] Capital investment in reservoirs, transmission, and treatment are generally financed by debt (for both investor-owned and publicly owned systems) and equity borrowing (for investor-owned systems only). Distribution system expansion is generally financed by developer and user hook-up charges with some reliance on borrowing. Operation costs and minor system improvements are generally financed by commodity rates; however, in the case of municipally owned systems, rate revenues are occasionally supplemented by subsidies from the local government.

Scale and Scope Economies

Both economies of scale and economies of scope, though different concepts, have applicability to water supply. A natural monopoly is thought to exist if a service or services can be supplied more efficiently by a single utility than by two or more utilities. Economies of scale should be viewed in the context of a single product or service firm; for example, a water utility providing only general water service. In this case, economies of scale are associated with the concept of natural

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[5] Lawton and Davis, *Commission Regulation of Small Water Utilities.*

[6] Patrick C. Mann, *Water Service: Regulation and Rate Reform* (Columbus, OH: The National Regulatory Research Institute, 1981), 7.

monopoly, but are not a necessary condition of natural monopoly. Economies of scope should be viewed in the context of a multiproduct or multiservice firm; for example, a water utility providing general water service as well as fire protection. In the multiple product/service case, the concept of natural monopoly requires economies of scope.

Economies of scale are often expected to occur in monopolies and are apparent when the average cost of providing a single product or service decreases as output or volume of service increases.[7] In other words, the unit cost of providing water service is expected to decline as system capacity is expanded. Many analysts contend that water utilities enjoy significant economies of scale.[8] According to recent research, economies of scale exist for treatment cost, but are somewhat less apparent for total system cost.[9] By comparison, some diseconomies of scale are apparent regarding the distribution system.[10]

As noted, table 2-3 reports ratios of assets to revenues generated for water systems according to the size of the community served. For the industry as a whole, economies of scale are indicated. This characteristic is also reflected in the ratios of assets per output of water, operating expenses per output of water, and revenues per sale of water, all of which decline as system size increases. The implication is that larger systems can produce water at a lower cost (in terms of both capital and operating expenses) and sell it at a lower price than smaller systems. More study is needed to determine whether declining ratios are related to the size or density of the population in utility service territories.

Another approach to the issue of scale economies is to examine assets per connection, as displayed in table 2-4. Such assets for production and treatment do not exhibit economies, even though there are scale economies in these areas with regard to water produced. Per-connection economies are not apparent for

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[7] Another measure of economies of scale is the ratio of average total cost to marginal cost (the cost of producing more units of output); economies exist if this value exceeds one.

[8] Robert M. Clark and J. M. Morand, "Package Plants: A Cost-Effective Solution to Small Water System Treatment Needs," *American Water Works Association Journal* 73 (January 1981): 24.

[9] Robert M. Clark, "Applying Economic Principles to Small Water Systems," *American Water Works Association Journal* 79 (May 1989): 57-61.

[10] Ibid.

TABLE 2-4

ASSETS PER CONNECTION FOR WATER SYSTEMS IN THE UNITED STATES

Community Size (persons)	Assets($)/Connection					
	Production and Treatment	Distribution	Other Plant and Equipment	Total Gross Plant	Total Net Plant	Total Net Assets
25-100	$43	$18,446	$5,934	$13,605	$19,756	$11,711
101-500	308	3,251	451	3,948	3,961	4,053
501-1,000	124	2,019	629	2,626	1,730	1,889
1,101-3,300	285	1,222	239	6,405	4,623	6,710
3,301-10,000	328	926	192	2,159*	1,185	1,583
10,001-25,000	211	750	173	1,879	1,437	1,758
25,001-50,000	212	873	102	1,437	1,083	1,639
50,001-75,000	222	839	95	1,272	925	2,041
75,001-100,000	452	1,140	97	2,186	1,850	2,353
100,001-500,000	206	1,069	213	1,553	1,212	1,766
500,001-1,000,000	171	1,414	472	1,615	1,267	1,662
Over 1,000,000	389	1,194	352	1,857	1,332	1,693
For all systems	$247	$3,409	$829	$7,336	$4,329	$4,660

Source: Frederick W. Immerman, *Financial Descriptive Summary: 1986 Survey of Community Water Systems* (Washington, DC: Office of Drinking Water, U.S. Environmental Protection Agency, 1987), table 5-3 .

* Authors' correction/estimation; source reports $21,590.

distribution and other plant and equipment categories as well. For total gross plant, total net plant, and total net assets, the ratio of assets to connections appears to decline somewhat, but not in a conclusive pattern. Thus, scale economies in water supply are more likely to be found in terms of water production than in terms of customer connections.

Although there is little research on this point, water utilities probably also enjoy economies of scope, which exist when the average cost of providing two or more products or services (in combination with one another) are less when provided by a single water utility than when two or more firms provide each of the services separately. An example is a single utility providing both general water service and fire protection service. If economies of scope exist, the unit cost of providing both services is less than if the services were provided by separate water utilities.

The water utility can be viewed as a multiproduct firm providing different types of water service. Kim and Clark found that significant economies of scale do not exist in overall water utility operation.[11] However, the typical water utility experiences substantial economies in providing residential service. The economies of scale achieved in water treatment are offset or negated by the diseconomies in water distribution. In contrast, water utilities in the aggregate experience economies of scope associated with the joint provision of residential and nonresidential service. Since their analysis incorporated a sample of sixty utilities that could be characterized as medium-sized water suppliers, the authors acknowledged that their empirical results did not preclude the possibility of substantial economies of scale for small utilities and moderate diseconomies of scale for large utilities.

Though independent, economies of scale and economies of scope interact to the extent that larger systems may be more capable of keeping unit costs down in their various areas of service. The desire to take advantage of scale and scope economies is central to the issue of water industry restructuring as envisioned by many federal and state policymakers.

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[11] H. Youn Kim and Robert M. Clark, "Economies of Scale and Scope in Water Supply," *Regional Science and Urban Economics* 18 (November 1988): 479-502.

Water systems are designed to meet both peak and off-peak (base) demand. The peak demand (peak load) for a water system is the maximum demand imposed on the system. Water service presents two basic types of peak demands: time-of-day peak demand and maximum-day (or seasonal) peak demand. The time-of-day peak demand is the specific hour or hours within the day that maximum-system demand is experienced. It is not simply a single hour within a day but instead is the hours within a day in which the water system experiences its peak demand. The maximum-day or seasonal peak demand is the specific day or days within the year that maximum-system demand is incurred. For some water systems, a time-of-week peak load may also be important; for example, weekends may produce increased residential use and decreased commercial-industrial use. The resulting compensating effect varies with the mix of commercial-industrial users as well as with residential spatial and usage patterns; therefore, the weekend effect and its impact on system peak loads can be unpredictable.[12]

The load factor for a water system is the ratio of average demand to peak demand. The load factor must be defined with reference to a specific time period or type of peak load, such as maximum-hour or maximum-day. Thus, the load factor is operationalized as the ratio of actual consumption over a period to the maximum (peak) demand multiplied by the length of a period (the period can be hourly, daily, monthly, or annually). The capacity utilization factor for a water system is closely related to the load factor in that it refers to the average system demand as a percentage of designed or rated system capacity. Given relatively high capacity costs, water systems tend to experience declining unit costs with increasing load factors and capacity utilization factors. Since most water systems maintain some reserve capacity beyond that necessary to meet peak demands, the difference between the capacity utilization factor and the load factor for a specific water system is determined by the amount of reserve capacity.

Peak demands are important parameters in the design and construction of water systems. Given that water systems must be capable of servicing peak demands and given the existence of time-of-day, time-of-week, and seasonal

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[12] W. R. Derrick Sewell and Leonard Roueche, "Peak Load Pricing and Urban Water Management: Victoria, B.C., A Case Study," *Natural Resources Journal* 14 (July 1974): 383-400.

consumption patterns, the result is intermittent and varying degrees of unused system capacity. To further complicate matters, water system components are generally designed to meet different types of demands. For example, raw water storage facilities, such as reservoirs, are generally designed to meet average annual demand; transmission and treatment facilities as well as major feeder mains are generally designed to absorb maximum-day demand; and distribution mains, pumping stations, and local storage facilities are designed to meet maximum-hour demand, or maximum-day demand plus fire protection flow requirements, whichever is greatest.[13] Thus water systems with identical average demands are designed differently if their peak demands differ.

The primary contributor to residential peak demands (which cause most system peak demands) is lawn and garden sprinkling. Since sprinkling is used to compensate for deficiencies in rainfall, its occurrence is influenced by temperature, precipitation, and the evapotranspiration rate.[14] Landscaping preferences and even cultural norms also may affect sprinkling demand. During dry periods, sprinkling probably accounts for a large share of residential peak demands. Also, from a load management perspective, there is little possibility that new types of winter water use will emerge to offset summer peak loads created by sprinkling demand.

Price Elasticity of Water Demand

In economics, demand is viewed as the inverse relationship between price and quantity consumed. The price elasticity of demand measures the percentage change in quantity demanded in response to a percentage change in price. That is, price elasticity measures the sensitivity of quantity consumed to price changes. Estimating price elasticity is an important component of demand forecasting and revenue projection. If a rate change is anticipated, its effect on demand and revenues must also be anticipated by utilities and their regulators.

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13 F. Pierce Linaweaver and John C. Geyer, "Use of Peak Demands in Determination of Residential Rates," *American Water Works Association Journal* 56 (April 1964); and Charles W. Howe and F. Pierce Linaweaver, "The Impact of Price on Residential Water Demand and its Relationship to System Design and Price Structure," *Water Resources Research* 3 (First Quarter 1967): 13-32.

14 W. Douglas Morgan, "Climatic Indicators in the Estimation of Municipal Water Demand," *Water Resources Bulletin* 12 (June 1976): 511-518.

In a demand model, the price elasticity of demand (n) is calculated as:[15]

$$n = \frac{\text{change in quantity/mean quantity}}{\text{change in price/mean price}}$$

where:

n	= 0.0		Perfectly inelastic demand
0.0	> n > -1.0		Relative inelastic demand
-1.0	> n > -infinity		Relatively elastic demand
n	= -infinity		Perfectly elastic demand

Water, since it is used in a wide variety of ways, is likely to be characterized by a number of different demand curves and each may reflect a different price elasticity. For some types of water use, a change in price is likely to bring about a substantial change in the quantity consumed. Water for swimming pools and landscapes may have price-elastic demands. In contrast, demand for water used for drinking, bathing, laundering, and other more fundamental needs may be more price-inelastic.

The principal research findings about price elasticity of water demand can be summarized as follows:[16]

- Aggregate municipal demand is relatively price-inelastic.
- Price elasticity appears to vary positively with water price levels; that is, there is more usage-price sensitivity with higher rates than with lower rates.
- The price elasticity of residential demand is similar to aggregate municipal demand except when disaggregated into seasonal and nonseasonal components, in which case seasonal demand is more elastic than nonseasonal demand.
- Commercial and industrial demands appear to be more sensitive to price changes than residential demand.

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[15] A linear model is appropriately applied to water demand. But it is relevant only in the range for which the analyst has data and results cannot be assumed valid for segments of the demand curve where prices are markedly different.

[16] Mann, *Water Service*, iii.

- The price-elasticity coefficients associated with water demand generally indicate that water rates changes can alter usage levels.

- The relatively low coefficients associated with residential demand along with evidence that average sprinkling demand is more sensitive to price than maximum sprinkling demand suggests that time-differentiated rates may be more effective than general rate increases in altering consumption patterns.

Estimates of price elasticities vary widely.[17] According to Baumann, the literature as a whole suggests that a likely range of elasticity for residential demand is between -0.20 and -0.40, which is relatively price-inelastic.[18] Although its statistical significance is questionable, an estimate of elasticity for industrial demand ranges between -0.50 and -0.80, somewhat less price-inelastic than the residential demand. The implication is that industrial users will tend to reduce consumption in response to price increases by a larger quantity than residential users. Presumably, a large enough increase will cause some of these users to seek alternative water supplies.

As part of a comprehensive analysis of water pricing in Tucson, Arizona, William E. Martin and others conducted a longitudinal analysis of changes in prices and quantities of water pumped in order to assess price elasticity.[19] In eleven of sixteen years studied, the researchers found the implied elasticity to be negative, as expected. While people appeared to respond to higher prices by cutting back consumption, the authors concluded that major cutbacks could only be expected when a rate increase was accompanied by enough publicity to increase public awareness. Further, price was only one of several variables, including weather, that

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17 For a summary, see U.S. Army Corps of Engineers as adapted by William O. Maddaus, *Water Conservation* (Denver, CO: American Water Works Association, 1987), 66; reprinted in Janice A. Beecher and Ann P. Laubach, *Compendium on Water Supply, Drought, and Conservation,* (Columbus, OH: The National Regulatory Research Institute, 1989), 242.

18 Duane D. Baumann, "Issues in Water Pricing," in Arizona Corporation Commission, *Water Pricing and Water Demand,* papers presented at a Water Pricing Workshop, Utilities Division, August 21, 1986, 7.

19 William E. Martin, et al., *Saving Water in a Desert City* (Washington, DC: Resources for the Future, 1984).

appeared to affect consumption significantly. In periods of drought, changes in water practices, perhaps induced by public information campaigns, actually may prove to be more influential than the simple price-quantity relationship.

Positive price-elasticity coefficients indicate that water rate changes have some potential for altering water usage levels and patterns. However, given findings that water price changes affect average sprinkling demand substantially more than maximum sprinkling demands, extreme demand patterns may be minimally affected by rate changes. Thus, a seasonal increase in price may provide an incentive to reduce average use during the summer, but not peak use on especially dry days.

The statistical findings regarding the price elasticity of water demand have several implications. The relationship of the quantity demanded of water service and price complicates the task of water system design. Water system design is a function of average and peak demands, which are a function of water price, which is a function of the cost of service, which is a function of system design, and so on, as illustrated in figure 2-1. Therefore, price-elasticity coefficients exceeding zero produce a circularity problem that can be difficult to resolve in the context of traditional public utility regulation.[20]

It has been said that since water is essential to life and no other good can be substituted for it, some small essential amount of water will always have a perfectly inelastic demand; that is, consumers will be willing to pay any price for it. Because water is necessary for human survival, some have argued that price should not be the principal allocation method during a severe water shortage.[21] However, while water itself cannot be substituted, its method of delivery can for most uses. Drinking water, for example, can come from the faucet, be brought home from the supermarket, or delivered in bottles. Some users can substitute publicly supplied water with water from their own wells and thus bypass the water utility. Industrial users may not require treated water at all. Some large users may relocate to areas with water service more suited to their needs. Recycling, as

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[20] In the electricity sector, this circularity problem is sometimes referred to as a "death spiral," meaning that rate shock leads to reduced consumption which leads to the need for another rate increase with more rate shock, and so on.

[21] David R. Dawdy, L. Douglas James, and J. Anthony Young, "Demand Oriented Measures," in Vujica Yevjevich, Luis da Cunha, and Evan Vlachos, eds., *Coping with Droughts* (Littleton, CO: Water Resources Publications, 1983).

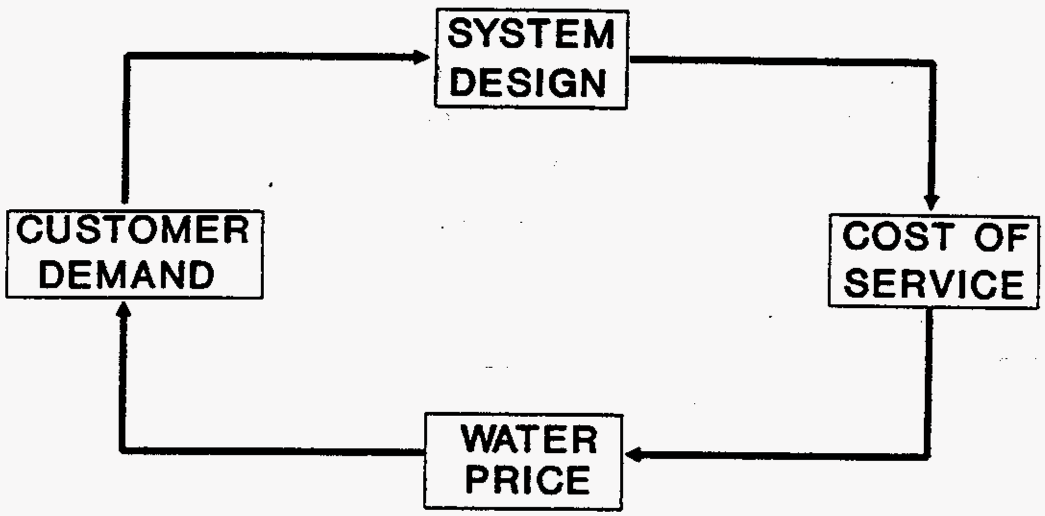

Fig. 2-1. The circularity of system design, cost of service, water price, and customer demand.

another example, substitutes "used" water for new withdrawals. In some instances, conservation in response to drought or other water shortages may have a permanent effect on water consumption habits.[22] These factors should be taken into account when estimating price elasticities of water demand.

Water Conservation

Water demand elasticities determine how much conservation occurs in response to a price change.[23] In some cases, conservation may occur naturally as prices edge upward due to increased costs and as consumers use more water-efficient appliances and change their behavior.[24] In other cases, sharp price increases may induce sudden usage reductions by moving consumers into a more price-elastic part of the demand curve. Any further price increase to remedy the revenue shortfall that results may not be appropriate since it may lead to further revenue losses.

When conservation measures or water use prohibitions are in full force absent an accompanying rate increase, utility revenues will be reduced. Some utilities may have difficulty covering their fixed costs. A rate increase, though unpopular, may mitigate this problem. According to one no-growth model, doubling the price of water results in a 32 percent reduction in demand but a 36 percent increase in revenue for the water utility.[25] Without a price increase, the revenue loss caused by the same level of conservation would be about $585,000 (32 percent). Since

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[22] Frank H. Bollman and Melinda A. Merritt, "Community Response and Change in Residential Water Use to Conservation and Rationing Measures: A Case Study--Marin Municipal Water District," in James E. Crews and James Tang, eds., *Selected Works in Water Supply, Water Conservation and Water Quality Planning* (Fort Belvoir, VA: Institute for Water Resources, U.S. Army Corps of Engineers, 1981), 393.

[23] These effects depend in part on the time lag inherent in the billing cycle. More frequent bills, received closer to the period of consumption, provide consumers with better information for changing their consumption behavior in response to the price for water service. For conservation purposes, monthly, bimonthly, or quarterly billing are preferable to semiannual or annual billing.

[24] Darryll Olsen and Alan L. Highstreet," Socioeconomic Factors Affecting Water Conservation in Southern Texas," *American Water Works Association Journal* 79 no. 3 (March 1987): 68.

[25] J. Ernest Flack, "Increasing Efficiency of Non-Agricultural Water Use," in Ernest A. Engelbert and Ann Foley Scheuring, eds., *Water Scarcity: Impacts on Western Agriculture* (Berkeley, CA: University of California Press, 1984), 147.

conservation can have an adverse effect on utility revenues, it may be necessary for a price increase when implementing a nonprice conservation strategy, such as a retrofit program, to meet the water supplier's revenue requirements. Thus a careful consideration of water price (including the billing cycle) is critical to any utility conservation effort, even if price itself is not the principal conservation tool.

Conservation through pricing can be an effective tool for managing demand when the objective is to avoid the need for additional capacity. In 1977, Dallas became one of the first major cities to adopt a pricing policy that imposed a surcharge on peak residential use. Although large peak-time users (more than 20,000 gallons in the summer) experienced a 58 percent rate increase, the overall increase in the revenue requirement was 12 percent. A preliminary assessment attributed a reduction in demand to the new pricing system, with water savings equivalent to the construction of a 50 to 75-million-gallon-a-day treatment plant.[26]

The elasticity of water demand is an important measure, but elasticity estimates do not always encompass all the variables that may affect water consumption behavior and reactions to price changes. As prices escalate, affordability becomes an issue for water service as it does for all public utility services. Price increases also bring about political reactions that may affect ratemaking and other regulatory processes. Further, these variables are dynamic rather than static. Thus estimates of elasticities and their effects cannot be made in a vacuum or without recognizing the effects of time.

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[26] I. M. Rice and L. G. Shaw, "Water Conservation--A Practical Approach," in American Water Works Association, *Water Conservation Strategies* (Denver, CO: American Water Works Association, 1980), 73.

CHAPTER 3

COST ALLOCATION FOR WATER UTILITIES

Cost allocation is an inexact but essential part of ratemaking for public utilities. Put simply, it involves the disaggregation of costs according to functions or services to which they can be attributed. Costs are allocated to the extent the analyst is able to attribute causality. The rate structure, then, is typically used to recover costs from those who cause them. Done well, rate structures mean that utilities are able to meet revenue requirements and consumers are sent appropriate pricing signals.

The application of cost-of-service criteria to water utility ratemaking is not a simple task. One significant problem with the cost approach is the subjectivity in cost measurement for specific services and user groups. The degree of subjectivity is a function of the lack of knowledge regarding the cost of specific water services, the costs of supplying specific consumer groups, and the cost of peak versus off-peak consumption. The cost-of-service principle can also generate a conflict between efficiency and simplicity. A rate structure or level based on costs of service may not be publicly acceptable and may not be easy to administer. Given the many participants (for example, city administrators, utility managers, customer groups, special users, bondholders, stockholders, and regulators) who can influence utility ratemaking, it is easy to understand why water ratemaking incorporates noncost elements. A wide variation in rates across water systems in the United States can generally be observed even within categories of the same size, ownership, and source of supply.[1]

It is readily acknowledged, then, that cost-of-service studies cannot provide definitive results since they unavoidably involve analyst judgment and other considerations. Yet there is an underlying presumption that utility rates should correspond to costs and that even rough methods for accomplishing this goal are better than methods that make no attempt to do so. This chapter describes the steps used in cost allocation, with an emphasis on the fully allocated (also referred

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[1] Patrick C. Mann, "The Water Industry: Economic and Policy Issues," in Charles F. Phillips, ed., *Regulation, Competition and Deregulation--An Economic Grab Bag* (Lexington, VA: Washington and Lee University, 1979), 105-6.

to as fully distributed or embedded) cost approach while the next considers marginal cost pricing. Chapter 5 turns to issues of rate design.

Revenue Requirements

The first step in utility ratemaking is to determine revenue requirements. An example of projected revenue requirements for a publicly owned water utility appears in table 3-1. Alternative methods exist for measuring (or forecasting) revenue requirements. In the regulation of privately owned utilities by state commissions, the utility or rate base/rate of return method prevails. An alternative approach emphasizes the utility's cash needs. The cash and utility bases for determining an identical total revenue requirement are compared in table 3-2. Although for public policy reasons there are differences between these approaches (and the utility and regulatory structures that underlie them), for ratemaking purposes the differences between the utility and cash bases should not be overstated because results may not vary significantly.

Methods

Rate Base/Rate of Return Method

The cost-of-service standard is at the heart of the rate base/rate of return method of determining revenue requirements, which specifies a return on the utility's capital investment and is depicted with the following formula:

$$RR = O\&M + D + T + r(RB)$$

where:

RR = annual revenue requirement
O&M = annual operation and maintenance expenses
D = annual depreciation expense
T = annual taxes (sales and income)
r = rate of return
RB = rate base (adjusted for accumulated depreciation).

Although it is an integral part of traditional public utility regulation and is supported by a broad base of expertise, the limitations of the rate base/rate of return method have been well documented. In sum, rate-of-return regulation may: (1) cause regulated firms to overinvest in capital, sometimes labeled "gold-plating,"

TABLE 3-1

PROJECTED REVENUE REQUIREMENTS FOR A PUBLICLY OWNED UTILITY

Expenditure Component	Expenditures Year 1	Year 2	Year 3
Operation-and-maintenance expense			
Source of Supply	$16,300	$17,700	$17,000
Pumping			
Power	145,500	159,900	152,700
Other	103,800	111,000	107,400
Treatment			
Chemicals	95,200	104,600	99,900
Other	67,300	71,900	69,600
Transmission and distribution			
Distribution reservoirs	13,600	14,400	14,000
Transmission mains	52,300	55,900	54,100
Distribution mains	34,000	36,400	35,200
Meters	92,500	100,700	96,600
Services	33,800	36,800	35,300
Fire hydrants	16,000	17,000	16,500
Other	58,000	62,000	60,000
Customer billing and collecting			
Meter reading	106,000	115,600	110,800
Billing and collecting	196,800	210,600	203,700
Other	11,400	12,200	11,800
Administration and general			
Fringe benefits	79,100	84,500	81,800
Other	293,400	313,800	303,600
Total O&M expense	1,415,000	1,525,000	1,470,000
Debt service requirements	462,000	458,000	460,000
Payment in lieu of taxes	175,000	175,000	175,000
Annual requirements for replacements, extensions, and improvements	189,000	201,000	195,000
Total revenue requirements	2,241,000	2,359,000	2,300,000

Source: American Water Works Association, *Water Rates* (Denver, CO: American Water Works Association, Manual M1, 1983), 6.

TABLE 3-2

COMPARISON OF UTILITY AND CASH BASES FOR EXPRESSING REVENUE REQUIREMENTS

Utility Basis	
Operation and maintenance expense	$259,000
Payment in lieu of taxes	189,000
Capital related costs:	
Depreciation	$126,000
Return	378,000
Total capital related costs	$504,000
Total revenue requirements	$952,000
Cash Basis	
Operation and maintenance expense	$259,000
Payment in lieu of taxes	189,000
Capital related costs:	
Bond debt service	214,000
Major capital improvements	150,000
Recurring improvements, replacements, and extensions	140,000
Total capital related costs	$504,000
Total revenue requirements	$952,000

Source: Robert F. Banker, "Distribution of Costs of Water Service to Customer Classes," in *AWWA Seminar on Developing Water Rates* (Denver, CO: American Water Works Association, 1973), III-17.

in order to inflate the rate base or otherwise use a suboptimal combination of inputs; (2) provide little or no incentive to minimize production costs, be technologically innovative, or respond to changes in consumer preferences; (3) encourage cost shifts (that is, cross subsidies) from unregulated to regulated parts of multifaceted firms; (4) create a real or perceived asymmetric risk to shareholders because of ex-post prudence reviews and other proceedings; and (5) be administratively costly because of extensive hearings, appeals, prudence reviews, oversight, and (in the extreme) micromanagement of the public utility.[2] High administrative or transaction costs often are cited as particularly problematic for small water utilities. Despite these issues, public utility regulation in the United States is a tradition well founded on legal and economic principles. To many, the advantages of regulation in curtailing the potential abuses of monopoly power far outweigh its limitations.

Cash-Needs Methods

Although rate base/rate of return regulation dominates, other methods for determining revenue requirements exist that emphasize the cash needs of the utility.[3] The simplest method may be the use of the utility's balance sheet, perhaps establishing a mechanism for reconciling surpluses and deficits on a year-to-year basis. Rates are used mainly to keep the utility financially viable.

The use of operating ratios has at times been suggested as an alternative method for determining revenue requirements. The operating-ratio technique (which has traditionally been used in motor carrier regulation) is a means of simplifying the regulatory process, particularly in the context of small water utilities having little or no capital investment or rate base. This approach also has appeal because of the chance that an operating margin will not be appropriately designated as a reserve to improve the utility's financial viability. Thus, the purpose of the operating ratio method is not to provide an adequate return on capital invested, but

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2 Kenneth Rose, "Regulated Utility Pricing Incentives with Price Cap Regulation: Can It Correct Rate of Return Regulation's Limitations?," a paper presented at the Forum on Alternatives to Rate Base/Rate of Return Regulation, sponsored by the Michigan Public Service Commission in East Lansing, Michigan (May 24, 1990).

3 American Water Works Association, *Revenue Requirements* (Denver, CO: American Water Works Association, Manual M35, 1990), 2-7.

rather to provide an adequate margin of revenues over expenses.[4] Operating ratios have been used by the commissions in North and South Carolina for small water systems.

Using operation and maintenance expenses as a substitute for the rate base, revenue requirements can be expressed by the following formula:

$$RR = O\&M + D + T + r(O\&M + D).$$

Using the operating ratio technique for rate base regulation does not eliminate the need for commission regulation. Regulators must set eligibility requirements for use of the method, determine appropriate operating ratios, and closely monitor the operating data for the utilities to which the method is applied. This method also may provide an incentive to inflate expenses, more so than rate-of-return regulation where expenses are passed through. Finally, as they mature, the investment profile of some water systems will change enough so that the operating ratio method may be an inappropriate tool for determining revenue requirements.

Still another substitute for rate of return regulation based on cash needs is the debt-service method, which shifts attention to the utility's debt. Revenue requirements are based on the sum of operating expenses and the amount necessary to service the utility's debt, both principal and interest. A variation of the debt-service approach is the "times-interest-earned ratio" (TIER), through which revenue requirements equal operating expenses plus a multiple of interest on long-term debt.[5] This method is frequently used by utilities having little equity investment, especially cooperatives and publicly owned utilities. At present, many small utilities have little debt because they have such difficulty securing it.[6] However, compliance with more stringent drinking water standards may increase the reliance on debt financing and thus stimulate interest in debt-service approaches, particularly for small systems.

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[4] Robert M. Clark, "Regulation Through Operating Revenues--An Alternative for Small Water Utilities," *NRRI Quarterly Bulletin,* 9 no. 3 (July 1988), 347.

[5] Deloitte Haskins & Sells, *Public Utilities Manual* (USA: Deloitte Haskins & Sells, 1984).

[6] An unexpected consequence of having little debt is that these small utilities sometime appear "less risky" according to certain debt-based measures of risk.

Factors Affecting Revenues

Water utility revenues--and revenue requirements--can be highly variable. Ratemaking must take this into account. A variety of factors affect revenues, including:[7]

- Number of customers served
- Customer mix
- Customer water use
- Nonrecurring sales
- Weather
- Conservation
- Use restrictions
- Rate changes
- Price elasticity

In addition to these factors, water utility revenue requirements also are affected by:[8]

- Inflation
- Interest rates
- Capital financing needs
- Tax laws and regulations
- Changes in economic conditions
- Changes in utility operations

The cost-of-service analyst must take these influences into account in estimating revenue requirements. Some factors, such as weather, can be accounted for with "normalization" techniques that use long-term historical averages to adjust for extreme cases in the short term. Others, such as conservation and price elasticity, can be analyzed using econometric methods. More difficult to account for because of problems in prediction and quantification are changes in tax laws, economic conditions, and utility operations. The choice of a test year may determine the need to make projections for these variables.

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7 Adapted from American Water Works Association, *Revenue Requirements* (Denver, CO: American Water Works Association, Manual M35, 1990), 3.

8 Ibid.

Test Year

Regardless of the method for determining revenue requirements, cost analysis requires the choice of a test year or test period, which is the annualized period for which costs are to be analyzed and rates established.[9] The test year may be an historical year, a future year, or a mixture of the two. The choice of an appropriate test year often is controversial because it involves a tradeoff between the certain nature of historic costs and the speculative nature of future costs. Accounting theory may be more compatible with historic data while economic theory--marginal-cost pricing in particular--is forward looking. Some state commissions may have statutory or regulatory constraints on the test year choice.

As reported in table 3-3, a majority of state regulatory commissions use an historic test year in water utility rate cases. Only a few state commissions use a future test year in water utility rate cases, while somewhat more mix historic and future data. Three states reported using an historic test year with some qualification. In Delaware, utilities may use either an historic test year or a test year with up to nine months of projected data. Illinois and Ohio indicated that an historic test year is allowed, provided the water utility is small. Illinois requires larger systems to use a future test year, while small water systems use an historic test year with an option to forecast. Ohio provides abbreviated filings for very small water systems in which they use an historic test year. All other water systems are required to develop a test year mixing historical data with projections. In a unique response, staff of the Michigan commission indicated that water utilities may choose any method to develop a test year.

Once revenue requirements are established for the test year of choice, the next step in ratemaking is to allocate the costs associated with those requirements to particular functional areas and to customer classes.

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[9] Ibid.

TABLE 3-3

TEST YEAR USED IN WATER UTILITY RATE CASES

State Commission	Test Year Used: Historic	Future	Mixed	State Commission	Test Year Used: Historic	Future	Mixed
Alabama	X	-	-	New Hampshire	X	-	-
Alaska	X	-	-	New Jersey	-	-	X
Arizona	X	-	-	New Mexico	-	-	X
Arkansas	-	-	X	New York(d)	-	-	X
California	-	X	-	North Carolina	X	-	-
Colorado	X	-	-	Ohio(e)	X	-	X
Connecticut	X	-	-	Oklahoma	X	-	-
Delaware(a)	X	X	-	Oregon	-	-	X
Florida	-	-	X	Pennsylvania(f)	X	-	-
Hawaii	-	-	X	Rhode Island	X	-	-
Idaho	X	-	-	South Carolina	X	-	-
Illinois(b)	X	X	-	Tennessee	-	-	X
Indiana	X	-	-	Texas	X	-	-
Iowa	X	-	-	Utah	-	-	X
Kansas	X	-	-	Vermont	X	-	-
Kentucky	X	-	-	Virginia	X	-	-
Louisiana	X	-	-	Washington	X	-	-
Maine	X	-	-	West Virginia	-	-	X
Maryland	X	-	-	Wisconsin	-	X	-
Massachusetts	X	-	-	Wyoming	X	-	-
Michigan(c)	X	X	X	Virgin Islands	-	-	X
Mississippi	-	-	X				
Missouri	X	-	-				
Montana	X	-	-				
Nevada	X	-	-	Number of Commissions	32	5	14

Source: 1990 NRRI Survey on Commission Regulation of Water Systems.

(a) Utilities may use an historic test year or a test year with up to 9 months projected.
(b) Small systems use historical test year with the option of forecasting; large systems use a future test year.
(c) At the utility's option.
(d) Projections for 12 months.
(e) Abbreviated filing for very small systems with historical test year. Other systems use a mixed test year.
(f) Not beyond a 12-month forecast for mixed historical and future test years.

Key Steps in Embedded-Cost Allocation

Embedded-cost allocation depends, first, on the availability of accurate and fairly detailed cost data. This may be facilitated by a uniform system of accounts. Most state regulatory commissions rely on the systems developed by the National Association of Regulatory Utility Commissioners (NARUC) for Class A utilities (revenues exceeding $750,000), Class B utilities (revenues between $150,000 and $750,000) and Class C utilities (revenues less than $150,000). Hawaii and Montana do not use the NARUC system while California, Massachusetts, and New York have developed their own systems of accounts for water utilities.[10] The NARUC accounting system for Class A water utilities appears in appendix A of this report. In addition to accounting information, cost allocation depends on system design and load data as well as any other information required to develop cost allocators.

Assuming that the necessary data are available, the allocation of water utility costs begins with functionalization. For water service, this involves categorizing costs into areas such as source development, pumping, transmission, treatment, storage, and distribution. Since functionalization is essentially based on engineering system design, there is relatively little controversy in this step. However, alternative sources of supply (such as purchased water) and nontraditional sources of capacity (such as leak detection and repair, and conservation programs), may require special attention in the development of functional categories. A more difficult area of cost functionalization is the treatment of joint or common costs, which requires development of allocation criteria. Finally, projections of future costs can be tricky, and care must be taken to place them in the appropriate functional categories.

As mentioned earlier, the next step involves classifying the cost of utility service according to customer, capacity (demand), and commodity (operating) costs. Fire protection costs can be classified separately as well. Customer costs are those associated with metering, billing, collections, and customer service. Capacity costs are those generally associated with the physical plant required to meet peak demands for water service. Because cost allocation is sensitive to how peak

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10 National Association of Regulatory Utility Commissioners, *NARUC Annual Report on Utility and Carrier Regulation 1988* (Washington, DC: National Association of Regulatory Utility Commissioners, 1989), 746.

demands are defined, care must be taken in their definition. Some of the available methods are:[11]

- Correlation analysis to determine those daily and seasonal periods that most appropriately reflect the margins of cost for the rating periods.

- Judgment to specify when the safe-yield of any capacity element must maintain a certain temporal reliability.

- Statistical and mathematical modeling to determine the intertemporal homogeneity of marginal costs.

- Practical considerations can be used based on rough and ready principles of calculating the probability of exceeding available system capacity, which may vary significantly for different periods.

Commodity costs vary directly with levels of production or consumption, such as those associated with treatment chemicals and energy. Fire protection costs are those associated with the flow requirements needed to fight fires. In classification, all costs must be appropriately accounted for (that is, "fully allocated") and particular attention should be paid to the effects of some costs on others.

Once total costs are functionalized and classified, the final step is to assign costs to service (or customer) classes. Although many water utilities serve only one or two service classes, the possibilities include residential, commercial, industrial, wholesale, institutional, public authorities, and fire protection. Cost assignment to customer classes, for the purpose of generating rates, usually involves assigning customer costs on the basis of service connections, assigning commodity costs on the basis of usage, and the difficult (and sometimes arbitrary) assignment of capacity costs. While some costs, such as fire protection and system development, are directly assignable to customers, most require the use of cost allocators.

A simple example of the allocation of unit costs appears in table 3-4. In this case, revenue requirements are defined for an investor-owned utility and costs are allocated between general water service and fire protection service. Fire protection costs are treated as incremental costs, and they affect virtually all of the other functional cost areas. Other approaches may be taken to allocating fire protection

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[11] Stephen L. Feldman, Robert Obeiter, Michael Abrash, and Martin Holdrich, *An Operational Approach to Estimating the Marginal Costs of Urban Water Supply with Illustrative Applications* (Unpublished report to the Wisconsin Public Service Commission, October 21, 1980), 28.

TABLE 3-4

ALLOCATION OF REVENUE REQUIREMENTS

Expense Function	Total Unit Costs (cents)	Allocation to: General Service (cents)	Allocation to: Fire Service (cents)
Operation and maintenance			
Source of supply	8.9	8.8	0.1
Pumping	7.7	7.6	0.1
Water treatment	3.3	3.3	0.0
Transmission and Distribution	6.7	5.0	1.7
Administration and General	13.0	11.3	1.7
Customer accounts	3.4	3.3	0.1
Taxes			
Federal	11.3	9.1	2.2
Local & state revenue	15.2	13.1	2.1
Real estate	1.1	1.0	0.1
Depreciation	4.9	4.0	0.9
Total operation and maintenance	75.5	66.5	9.0
Interest and carrying charges	10.8	8.6	2.2
Stockholder payments	11.9	9.5	2.4
Balance for capital additions	1.8	1.4	0.4
Total revenue requirement	100.0	86.0	14.0

Source: J. Richard Tompkins, "Fire Protection Charges," in *AWWA Seminar on the Ratemaking Process: Going Beyond the Cost of Service* (Denver, CO: American Water Works Association, 1986), 25.

costs.[12] One is to allocate primary costs to fire service and incremental costs to general service; another is to allocate costs on a proportional basis. However, the allocation of incremental cost to fire service may be a least-cost approach to this issue. The allocation of fire service costs to customer classes can be based on population, service connections, fire hydrants, hydrants per inch-foot, acreage, housing stock, fire-flow factors, or other criteria. For example, fire demand requirements for the different customer classes can yield fire-flow factors as depicted in table 3-5. In this case, the water system serves mainly residential and commercial customers and requires an average fire flow of about 2,400 gallons per minute (gpm). These factors can be used to allocate the cost of transmission facilities among service classes as well as among service territories, such as different municipalities served by one utility.

TABLE 3-5

COST ALLOCATION BASED ON FIRE-FLOW REQUIREMENTS

Customer Classification	Area Acres	Flow Assigned (gpm)	Fire Flow Factor
Residential	11,000	1,000	11,000
Commercial	6,300	3,000	18,900
Industrial	4,700	5,000	23,500
Total	22,000	2,400	53,400

Source: J. Richard Tompkins, "Fire Protection Charges," in *AWWA Seminar on the Ratemaking Process: Going Beyond the Cost of Service* (Denver, CO: American Water Works Association, 1986), 23.

[12] J. Richard Tompkins, "Fire Protection Charges," in *AWWA Seminar on the Ratemaking Process: Going Beyond the Cost of Service* (Denver, CO: American Water Works Association, 1986), 19-28.

Cost allocation is a prerequisite to rate design (addressed in the next chapter). Rates generated from a cost study should be analyzed in terms of revenue implications. Rates that depart significantly from current levels or have unexpected effects on revenues should lead the analyst to verify the parameters of the cost study, including allocation criteria and methods, to check for possible errors. However, the reconciliation of costs and revenues ultimately is the responsbility of decisionmakers who may wish to take into account additional regulatory principles and public policy considerations.

Criteria

Cost allocation is made less arbitrary with the development of appropriate criteria on which cost analysts may rely. Several cost assignment criteria may be appropriate in allocating water utility costs:[13]

- Cost causation
- Traceability
- Variability
- Capacity required
- Beneficiality

The first criterion--and perhaps the most important--is cost causation. This emphasizes that costs should be assigned to the revenue generating customers or services that cause the costs to be incurred. A closely related criterion, traceability, means that costs to be assigned must be identified with a revenue generating unit, that is, a customer class. Traceability (a primary test of cost causation) implies that costs and their causes either are empirically observable or conceptually logical. Variability suggests that costs, although not necessarily traceable, can vary with the usage volume associated with the revenue generating unit. This criterion (a secondary test of cost causation) implies that certain costs exhibit a systematic relationship with specific measures of output. A fourth criterion is capacity required, which means that costs are assigned according to whether the service could have been rendered if the specific costs had not been

[13] William Pollard, *A Peak-Responsibility Cost-of-Service Manual for Intrastate Telephone Services: A Review Draft* (Columbus, OH: The National Regulatory Research Institute, August 1986).

incurred. (This also may be a secondary criterion that can be applied in cases where both the traceability and variability criteria fail to be instructive in cost allocation.) The criterion of last resort is beneficiality, which suggests that costs are assigned to customers or services that benefit from the costs; that is, incurring the cost is necessary to providing the service. This criterion implies that without the cost being incurred, the service would be provided inefficiently. Perhaps the most prominent application of the beneficiality criterion in water supply is in the allocation of fire protection costs.

Methods

An early approach to water utility cost allocation is known as the functional-cost method.[14] It emphasizes the separation of costs into those associated with: (1) production and transmission, (2) distribution, (3) customer costs, and (4) hydrants and connections. Customer costs could be divided further into (a) meters and services and (b) customer billing and collections. The method has been criticized for its overreliance on analyst judgment and its failure to account fully for those costs driven by capacity or demand.[15] However, the functional-cost approach laid the groundwork for more sophisticated methods that are more responsive to these criticisms. Also, for the very smallest water utilities a functional-cost analysis may be better than no cost analysis at all.

Today, the cost-of service approach is usually associated with what are known as fully allocated or fully distributed methods that involve cost allocation based on variations in demand for utility services. Although there are many variations, two distinct approaches can be found to the full allocation of costs: the peak responsibility method and the noncoincidental-peak responsibility method.[16]

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[14] American Water Works Association, *Water Rates*, 21-22.

[15] Ibid.

[16] National Economic Research Associates, "An Overview of Regulated Rate-Making in the United States" (February 1977); and Robert J. Malko, Darrell Smith, and Robert G. Uhler, "Topic Paper No. 2: Costing for Rate-Making" (August 1981), in *Electric Utility Rate Design Study Report to the National Association of Regulatory Utility Commissioners* (Palo Alto, CA: Electric Utility Rate Design Study Group).

The peak responsibility method is also known as the coincident peak or Wright method. It considers both the magnitude of peak demand and its timing but does not incorporate average demand or volume of usage in the allocation of capacity costs. The allocation basis is the user class contribution to system peak demand. Its conceptual base is that those users who cause peak demand should pay for the capacity required to supply it. Off-peak users are presumed not to affect capacity requirements and capacity costs.

Several criticisms have been leveled at the peak responsibility method. Primarily, it assigns no capacity costs to off-peak users thus producing the criticism that such users should not be relieved entirely of the capacity cost burden. For example, off-peak usage contributes to the incremental capacity required to permit the scheduling of routine system maintenance. Another criticism is that the assignment of all capacity costs to peak services creates the potential for unstable (shifting) peaks. A criticism, however, that has less merit is that users with 100 percent load factors do not contribute to system peak demand and therefore should be assigned no capacity costs. This argument ignores the concept that all users at system peak demand are coresponsible for the peak demand; that is, if the 100 percent load-factor-user shifts consumption from peak to off-peak, less system capacity is required.

The noncoincidental peak method is also known as the class maximum demand or Hopkinson method. In the American Water Works Association's rates manual, the commodity-demand method is an example of this approach.[17] It distinguishes between customer costs, commodity costs, and demand (capacity) costs. An example of this method appears in appendix B.

Noncoincidental methods such as this consider the magnitude of peak demand but do not incorporate either the timing of peak demand or usage (average demand) in the allocation of capacity costs. The allocation basis is the customer class contribution to the sum of the maximum demands for all user classes. By ignoring direct responsibility for system peaks, the method allocates some capacity costs to all user classes. Criticisms of the method include an insufficient adherence to the cost causation standard and inadequate recognition of the benefits of off-peak demand.

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17 American Water Works Association, *Water Rates* (Denver, Colorado: American Water Works Association, 1983).

Many fully allocated or fully distributed cost methods have capacity cost allocations based on both demand and consumption. Most of these methods are variations of the average-and-excess demand method, also described by the American Water Works Association as the base-extra capacity method.[18] An example appears in appendix C.

The base-extra capacity method, or Greene method, distinguishes between customer costs, base capacity costs, and extra capacity costs, meaning capacity needed to meet hourly, daily, or other peak demands. Thus it considers both peak demand and average demand but does not directly incorporate the timing of demand in the allocation of capacity costs. The approach involves an initial estimation of capacity costs assuming all users are operating at a 100 percent load factor. These estimated base capacity costs are allocated to user classes on the basis of usage. The extra or excess capacity costs then are allocated on the basis of the excess of maximum demand over average demand for each user class. The noncoincident-peak responsibility method is generally used in calculating the class maximum demand. Examples of the determination of allocation bases for facilities designed for maximum-day use and maximum-hour use are depicted in table 3-6.

TABLE 3-6

EXAMPLE OF DETERMINATION OF ALLOCATORS USING BASE-EXTRA CAPACITY METHOD

							Allocation Percentages		
								Extra Capacity	
Type of Use		Quantities		Ratio		Base		Maximum Day	Maximum Hour
Average Day Use	=	10 mgd	=	1.0	=	66.7		-	-
Maximum Day Use		15 mgd		1.5		-		33.3	-
Average Day Use	=	10 mgd	=	1.0	=	40.0		-	-
Maximum Hour Use		25 mgd		2.5		-		-	60.0

Source: Joseph M. Spaulding, "Revenue Requirements and Allocation to Functional Cost Components," in *AWWA Seminar on Developing Water Rates* (Denver, CO: American Water Works Association, 1973), II-19.

18 Ibid.

The base-extra capacity method makes little distinction between peak and off-peak demand thus violating the cost causation standard. However, it does have validity in apportioning some capacity costs on the basis of usage; that is, higher load-factor customers have higher probabilities of system peak contribution than lower load-factor customers. In brief, base-extra capacity implicitly employs class load factors as a measure of peak responsibility; thus, certain benefits flow to low load-factor classes. The average-and-excess demand method implies that peak demand is only responsible for the incremental costs incurred because of increased demand levels. That is, peak demand is not responsible for all system capacity costs.

In general, fully allocated cost methods suffer from certain deficiencies. All methods other than the peak responsibility method permit user classes to shift usage from off-peak to peak (thus increasing capacity costs) without increasing their class cost allocation. This occurs particularly when class peak demand at system peak is less than class average demand. The application of the various noncoincident peak responsibility methods can result in the inefficient utilization of existing capacity and increased system capacity requirements. There is also a tendency to channel difficult to allocate costs (for example, administrative costs) into the customer category. In these somewhat arbitrary cost assignments, value of service criteria may prevail.

Commission Staff Perspectives on Cost Analysis

As reported in table 3-7, twenty-four of the state commissions require some form of cost analysis in conjunction with water rate proceedings. Eighteen commissions require cost analysis of all water utilities in all rate cases. The New Jersey Commission requires the completion of a cost analysis on a case-by-case basis, while in six states the requirement depends on company size defined either by annual revenues or number of customers. For example, the commissions in Montana and Pennsylvania reported that cost analysis requirements applied only to companies having annual revenues exceeding $50,000 and $700,000, respectively. The other states with size stipulations reported only that larger companies were subject to cost analysis requirements.

TABLE 3-7

WATER UTILITY COST ANALYSIS

State Commission	Are cost studies required?	Who performs the cost analysis?	Characterization of cost analysis used by regulated water systems (a) FC	CD	BX	FA	MI	O	U
Alabama	no	staff	-	-	-	-	-	(b)	-
Alaska	yes	utility	-	-	-	X	-	-	-
Arizona	no	staff	-	-	X	-	-	-	-
Arkansas	yes	both	-	X	-	X	-	-	-
California	yes	both	-	-	-	-	-	(c)	-
Colorado	no	n/a	-	-	-	X	-	-	-
Connecticut	yes	utility	-	X	X	X	-	-	-
Delaware	yes	both	-	-	-	X	-	-	-
Florida	no	staff	-	-	-	-	-	(d)	-
Hawaii	no	n/a	-	-	-	-	-	(e)	-
Idaho	no	n/a	-	-	-	X	-	-	-
Illinois	no	both	-	-	(f)	-	-	-	-
Indiana	no	both	X	X	X	X	X	-	-
Iowa	no	n/a	-	-	-	X	-	-	-
Kansas	yes	utility(g)	-	-	-	X	-	-	-
Kentucky	yes(h)	utility	X	-	-	X	X	-	-
Louisiana	no	n/a	-	-	-	X	-	-	-
Maine	no	utility	-	-	-	-	-	(i)	-
Maryland	no	n/a	-	-	-	-	-	(j)	-
Massachusetts	no	utility	-	-	-	X	X	-	-
Michigan	yes	utility	-	-	-	-	-	(k)	-
Mississippi	yes	staff	X	-	-	-	-	-	-
Missouri	yes	both	X	X	X	X	-	-	-
Montana	yes(l)	utility	-	-	-	X	-	-	-
Nevada	yes(h)	both	X	X	X	X	X	-	-
New Hampshire	no	utility	-	-	X	-	-	-	-
New Jersey	yes(m)	utility	-	X	X	-	X	-	-
New Mexico	yes	both	-	-	-	X	X	-	-
New York	yes	both	-	-	-	X	-	-	-
North Carolina	no	staff	-	-	-	-	-	(n)	-
Ohio	yes(o)	both	-	-	X	-	-	-	-
Oklahoma	no	n/a	-	-	-	X	-	-	-
Oregon	yes	staff	-	X	-	X	-	-	-
Pennsylvania	yes(p)	utility	-	-	X	-	-	-	-
Rhode Island	yes	utility	-	-	-	X	X	-	-

TABLE 3-7 (continued)

State Commission	Are cost studies required?	Who performs the cost analysis?	Characterization of cost analysis used by regulated water systems(a) FC	CD	BX	FA	MI	O	U
South Carolina	no	n/a	-	-	-	-	-	-	X
Tennessee	no	n/a	-	-	-	-	-	-	X
Texas	yes(q)	utility	-	(r)	X	-	-	-	-
Utah	no	n/a	-	-	-	-	-	(b)	-
Vermont	yes	both	-	-	-	X	-	-	-
Virginia	no	n/a	-	-	-	-	-	-	X
Washington	no	utility	-	-	-	X	-	-	-
West Virginia	yes	both	X	X	-	-	-	-	-
Wisconsin	yes	both	-	-	X	-	-	-	-
Wyoming	yes	both	-	-	-	X	-	-	-
Virgin Islands	yes	staff	-	-	-	-	-	-	X
Times mentioned			6	9	12	23	7	9	4

Source: 1990 NRRI Survey on Commission Regulation of Water Systems.

(a) FC = Functional-cost
CD = Commodity demand
BX = Base-extra capacity
ED = Embedded direct
FA = Fully allocated/distributed/embedded
MI = Marginal/incremental
O = Other (as noted)
U = Unknown

(b) Accrual basis.
(c) Fixed cost and commodity cost.
(d) Fixed cost and variable cost.
(e) Original cost.
(f) On an embedded basis.
(g) Commission staff may assist smaller systems.
(h) Requirement for large systems only.
(i) Wisconsin method.
(j) Original cost or fair value.
(k) Actual book cost (accrual method).
(l) Requirement for systems with revenues in excess of $50,000 annually.
(m) On a case-by-case basis.
(n) Rate base method; operating ratios or cost plus.
(o) Requirement for large systems (in excess of 15,000 customers) and medium sized systems (5,000 to 15,000 customers).
(p) Requirement for systems having revenues in excess of $700,000 annually.
(q) Depending on size of system.
(r) Commodity-demand (fixed costs and variable costs).

The survey revealed that cost analysis is performed in its entirety by commission staff in seven jurisdictions and by the utility in fourteen jurisdictions. In the remaining commissions, the responsibility for performing a cost analysis is split between the utility and the commission staff. The Kansas Corporation Commission reported that although water utilities are required to perform cost analyses, the commission staff may assist smaller water utilities in completing cost studies. Interestingly, not all the commissions mandating cost studies shift the entire burden of performing such analysis onto the water utility. In twelve jurisdictions, the commission and the utility share the responsibility. In three of the states that mandate cost analysis, the commission staff performs the cost study. Altogether, commission staffs are involved in developing cost studies in their entirety or on a shared basis in twenty-one of the jurisdictions surveyed.

Regarding methods of cost analysis, also reported in table 3-7, the survey revealed that a variety of approaches are used by regulated water systems for purposes of cost analysis. Many state commission staff members characterize water utility cost studies as fully allocated costing (including fully distributed and embedded cost analysis). Several jurisdictions indicated that regulated water utilities use two or more methods of cost analysis. Indiana, Missouri, and Nevada are noteworthy for the variety of cost studies that come before them.

Results of the survey indicate a rather widespread use of the ratemaking manuals produced by the American Water Works Association, as reported in table 3-8. Over half of the jurisdictions surveyed reported the use of American Water Works manuals; seven jurisdictions indicated they used the manuals primarily as a general reference tool. Additional comments provided on the survey indicated that most found the manuals to be highly useful. However, it was noted that further attention could be paid to specific types of costs and charges, with more detail provided on the different steps in cost analysis. Another comment was that many small water system managers lack the expertise or resources to use the manuals effectively.

Finally, reported in table 3-9, the survey responses expose a variety of concerns about specific cost allocation issues affecting water provision. Commission staff in the jurisdictions under survey detailed twenty-one separate costing issues affecting water utilities. It appears that in terms of costs and their effects on water utilities, commission staff overwhelmingly are concerned with the impact of

TABLE 3-8

USE OF AMERICAN WATER WORKS ASSOCIATION RATEMAKING MANUALS

State Commission	Used by Commission	Used by Utilities	State Commission	Used by Commission	Used by Utilities
Alabama	yes	nk	New Hampshire	yes	yes
Alaska	yes*	nk	New Jersey	yes	nk
Arizona	yes	nk	New Mexico	yes	nk
Arkansas	no	nk	New York	yes	nk
California	yes*	nk	North Carolina	no	nk
Colorado	no	nk	Ohio	yes	yes
Connecticut	yes	yes	Oklahoma	yes*	yes(a)
Delaware	yes	yes(a)	Oregon	yes	yes
Florida	yes*	nk	Pennsylvania	yes	yes
Hawaii	no	nk	Rhode Island	yes	nk
Idaho	no	nk	South Carolina	no	nk
Illinois	yes	nk	Tennessee	no	nk
Indiana	yes	yes	Texas	yes*	nk
Iowa	no	yes	Utah	yes*	no
Kansas	nk	nk	Vermont	no	nk
Kentucky	yes	nk	Virginia	no	nk
Louisiana	no	nk	Washington	yes	nk
Maine	yes	nk	West Virginia	yes	yes
Maryland	no	nk	Wisconsin	yes	nk
Massachusetts	no	yes(b)	Wyoming	no	nk
Michigan	no	nk	Virgin Islands	no	nk
Mississippi	no	nk			
Missouri	yes	nk			
Montana	yes	yes			
Nevada	yes*	nk	Number of commissions responding yes	28	12

Source: 1990 NRRI Survey on Commission Regulation of Water Systems.

* Primarily as a general reference.

nk = not known.
(a) = some systems.
(b) = large systems.

TABLE 3-9

MOST IMPORTANT COST ALLOCATION ISSUES AFFECTING WATER UTILITIES ACCORDING TO STATE COMMISSION STAFF MEMBERS

Issue	Number of Times Mentioned
SDWA compliance/water quality improvements	24
System upgrade/infrastructure improvements	8
Financial viability of small systems	5
Capital costs/debt	4
Supply/water source costs	4
Conservation related steps	4
Labor costs/professional services/salaries	4
Payment and allocation of fire protection costs	3
Resale rates/price discrimination	2
Taxes/federal taxes on contributed plant	2
Appropriate rates of return for subsidiaries	1
Marginal versus embedded cost analysis for new supplies	1
Importance of rate design in cost recovery	1
Obtaining load data	1
Administrative costs	1
Pumping costs (energy)	1
Chemical costs	1
Maintenance costs	1
Metering costs	1
Insurance and liability	1
Water rights	1

Source: 1990 NRRI Survey on Commission Regulation of Water Systems.

safe drinking water requirements on the cost of water provision. The next most frequently mentioned issue of concern related to the cost of system upgrade or infrastructure improvements. Costing issues relating to financial viability of small systems, capital costs and debt, water supplies, conservation, and professional and labor related costs each were mentioned by roughly 10 percent of the responding jurisdictions. Furthermore, a host of costing issues ranging from pumping and chemical costs to rate design and load data concerns were mentioned. The results clearly indicate that a wide range of cost allocation issues affecting water utilities are making their way onto commission agendas.

Conclusion

Costing analysis is not an exact science. Traditional or conventional cost allocation has the potential for arbitrary cost assignments with no definitive scientific, economic, or accounting basis. Much depends on the analyst devising the cost-of-service analysis. Thus, the cost results are, at best, only estimates of actual costs of service. In brief, all cost studies involve judgments and should be viewed as starting points rather than presumptive determinants of rate design. In sum, there is no single "correct" costing method, particularly for the allocation of system capacity cost. In this context, a range of cost studies is desirable (including marginal and incremental cost analyses), since substantially divergent results can be achieved depending on the judgments involved. A range of studies is highly desirable for planning purposes as well.

CHAPTER 4

MARGINAL-COST PRICING APPLIED TO WATER UTILITIES[1]

Central to the issues of cost allocation and rate design is contemporary economic theory, which is used by decisionmakers to understand certain consequences of policy choices. Among other things, theories raise expectations that certain decisions will have certain outcomes. This chapter reviews marginal-cost pricing theory as applied to the case of water supply utilities. Attention is paid to the theoretical and applied aspects of the theory as well as to specific formulations for its use. Also included is a presentation of a method for calculating simple incremental costs based on a least-cost planning perspective and a comparison of the fully allocated and marginal cost approaches.

Marginal Cost in Theory and Practice

Economic theory argues for pricing resources at marginal costs to ensure their efficient allocation, thus maximizing consumer welfare. Marginal cost is among the prevailing standards by which achievement of the competitive ideal is measured, not just by economists but by regulators and judges as well. Prices that accurately reflect marginal or incremental costs send a signal to consumers about consumption, which in turn sends a signal to producers about production.

Marginal cost is defined in economic theory as the derivation of the total cost function with respect to output. Unfortunately, this definition obscures both the conceptual and pragmatic problems that can be experienced in estimating the marginal cost of water service.

Put more simply, marginal cost is the additional cost of producing or selling a single incremental unit.[2] The marginal cost of water service is the cost incurred in providing more water service. In practical terms, the two essential components

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1 This chapter is based in part on Patrick C. Mann, *Water Service: Regulation and Rate Reform* (Columbus, OH: The National Regulatory Research Institute, 1981).

2 See Patrick C. Mann and Donald L. Schlenger, "Marginal Cost and Seasonal Pricing of Water Service," *American Water Works Association Journal* 74 no. 1 (January 1982): 6.

of marginal cost are, first, the change in operating costs caused by changing the utilization rate for existing capacity and, second, the cost of expanding capacity, including the operating costs associated with the increased capacity. If the water utility is operating below capacity, marginal cost involves the incremental operating cost of producing more product units within the existing system capacity. In contrast, if a capacity increment is required, marginal cost involves the new capacity costs as well as the operating cost associated with the capacity increment. Calculating marginal costs involves projecting capacity and operating costs for a specified time span given a particular demand forecast. Such projections must take into account certain characteristics of water utilities themselves as well as potential influences on demand, including price.

The welfare principles that underlie marginal-cost pricing theory, as well as the allocative implications of the marginal-cost pricing rule, were set forth by Ruggles.[3] Works by Vickrey and Wiseman are excellent sources for some of the key theoretical objections to marginal-cost pricing.[4] These objections include the theory's limited value in selecting among alternative investments, the distortion effects on income distribution, and the value judgments implicit in applying marginal-cost pricing. Works by Steiner and Hirshleifer provide the early theoretical discussion of peak-load pricing, that is, its marginal-cost aspects and the pricing efficiency implications posed by variations in demand over time.[5]

The arguments for marginal-cost pricing involve economic efficiency and correct price signals. Prices for water service that equal marginal cost generate an efficient allocation of resources. The logic is that consumers are being induced to use water efficiently since the value they place on additional units of water is equal to the value they place on additional units of alternative or sacrificed goods. If water rates are unequal to marginal cost, consumers are receiving incorrect

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[3] Nancy Ruggles, "The Welfare Basis of the Marginal Cost Pricing Principle," and "Recent Developments in the Theory of Marginal Cost Pricing," *Review of Economic Studies* 17(1949-1950): 29 and 107, respectively.

[4] William Vickrey, "Some Objections to Marginal Cost Pricing," *Journal of Political Economy* 56 (June 1948): 218-238; and J. Wiseman, "The Theory of Public Utility Price," *Oxford Economic Papers* 18 (February 1957): 56-74.

[5] Peter O. Steiner, "Peak Loads and Efficient Pricing," *Quarterly Journal of Economics* 71 (November 1957): 585-610; and Jack Hirshleifer, "Peak Loads and Efficient Pricing: Comment," *Quarterly Journal of Economics* 72 (August 1958): 451-62.

signals regarding the resources used in water production; therefore, they will tend to consume either too little or too much water. Conservation is incorporated into the economic efficiency concept but economists generally do not view decreasing consumption in itself as a meaningful goal. That is, conservation is not decreasing usage per se, but instead involves the operation cost and capacity savings from efficient (marginal-cost) pricing.

Water rates based on marginal cost provide the foundation both for attaining an efficient utilization of water system capacity and attaining efficiency in capacity investment. Marginal-cost prices send signals to consumers about the resource cost consequences of their consumption decisions and, conversely, reflect the cost savings if consumers forego the consumption of additional units of water service. The ultimate purpose of marginal-cost pricing is to provide correct price signals for consumption decisions. Thus, when consumers affect water system costs by altering their consumption patterns, their bills change accordingly. In brief, marginal-cost prices reflect the immediate and near-term future cost consequences of usage decisions rather than the historical cost consequences of consumption decisions. Since pricing affects future usage decisions, not past usage decisions, future costs are those relevant for pricing.

In simple terms, economic efficiency is a standard which signals that no further reallocation of resources (either to or from the provision of water service) would enhance consumer satisfaction. The price equal to marginal-cost equation is the best available measure of attaining this standard. For example, price is the best proxy for the value placed on additional units of water service; marginal cost is the best proxy for the value placed on additional units of alternative goods. By water prices reflecting the immediate and near-term future costs of resources used or saved in water consumption, the marginal-cost approach implies a concept of equity in which consumers pay for these costs. In contrast, water prices based on average historical costs create the illusion that resources that can be used or saved at present or in the near-term future cost as much or as little as in the past. The approach implies a concept of equity in which consumers pay for the past costs of consumption decisions.

There are numerous ways of conceptualizing marginal costs: avoidable costs, product-specific costs, single and multiproduct costs, total service incremental costs, and average incremental costs are among the choices.[6] Incremental cost is a concept similar to marginal cost. While theoretical marginal cost refers to one-unit changes in output (such as a gallon of water), incremental cost can refer to larger changes in output (such as a million gallons of water), but also can refer to nonoutput changes (such as a change in water quality or system reliability). In addition, incremental costs can reflect changes in total cost over time. Economic purists prefer to use one gallon rather than a million gallons because it is truer to the theoretical idea of change at the margin. The incrementalist perspective is less rigorous but more practical. Nonetheless, for most purposes the concepts of marginal and incremental cost are virtually interchangeable.

There are also alternative ways of estimating marginal costs.[7] The three basic approaches are engineering process models, econometric models, and optimization or simulation models. Engineering process models emphasize engineering estimates about the cost of alternative supply options. Econometric models use statistical techniques to estimate costs on the basis of the behavior of key cost-causing variables. Such models are frequently used in predicting demand as well. Optimization models combine engineering and economic constraints to achieve an equilibrium, as depicted in figure 4-1. Some alternative ways of measuring marginal costs in water supply are summarized in table 4-1.

Not everyone subscribes to the economist's social welfare paradigm, with its accompanying faith in the competitive ideal. Nor does everyone agree on its application to cost allocation and rate design decisionmaking or the appropriate method for doing so. Yet even if one does not see marginal-cost pricing as a means to economic efficiency, it still can be counted among the most important tools for cost allocation, rate design, and planning. At the very least, an understanding of marginal costs is helpful in evaluating other prospective analytical methods. What other goals the method achieves depends on one's perspective and policy goals.

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6 For an overview, see William Pollard, "Economic Theory Relevant to Marginal and Incremental Cost Estimation," a paper presented at The National Regulatory Research Institute's Telephone Cost-of-Service Symposium in Columbus, Ohio (August 12-17, 1990).

7 Ibid.

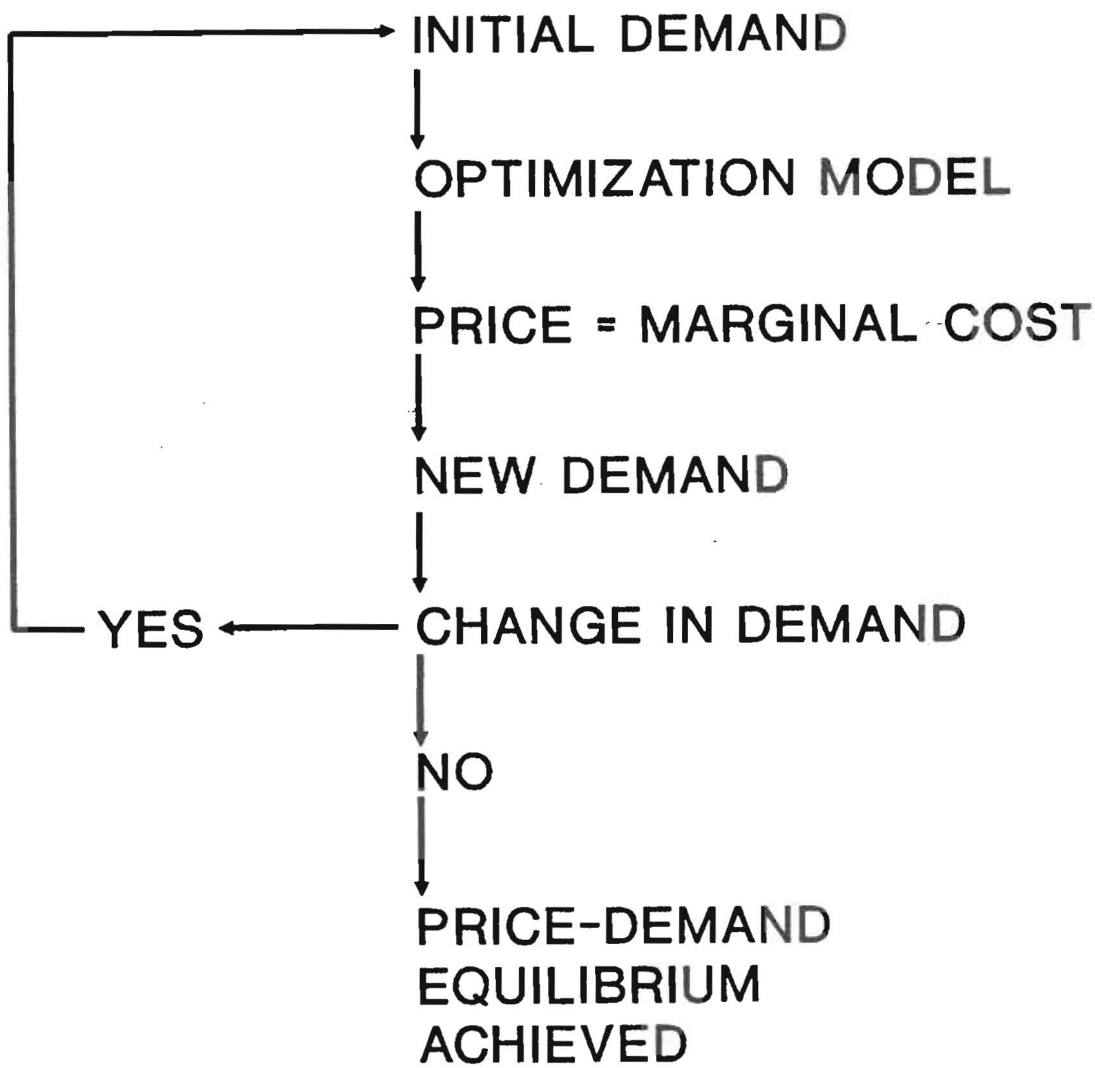

Fig. 4-1. Price-demand equilibrium analysis.

TABLE 4-1

SOME ALTERNATIVE METHODS FOR CALCULATING MARGINAL COSTS

Short-run Costs

- Estimate the average of past observed operating costs for each of the rating (such as, peak and off-peak) periods. These costs are then averaged for each rating period.
- Take some average of hourly operating costs for a given rating period from an economy dispatch model--that is, optimizing the dispatch of pumping stations and water tower discharge.
- Examine short-run operating costs and certain fixed costs with respect to meeting load requirements for any given hour.
- Determine the change on the long-run total cost function with varying load conditions. The change in costs can be calculated using the cost difference from one optimal system design to another as a result of a new load duration curve.
- Derive a set of hourly operating costs from an economy dispatch model. Rating periods can be chosen on the basis of the cost data.
- Derive the operating cost of the peaking plant or a hypothetical plant, simulated with a change in load conditions.
- Derive the operating costs of a rating period subject to a safe yield or reliability constraint.

Source-related Capacity Costs

- Derive the difference between hypothetical expansion plans that are totally peak related and calculate the cost in present value terms. (Some system expansions, such as reservoirs or wells, may be used for peak capacity only).
- Derive the annual incremental cost of any added capacity cost as a result of an expected increase or change in load, allocating these costs to the rating periods on the basis of the ratio of loads between periods.
- Determine the incremental capital costs of all new units and allocate them to the appropriate rating period.
- Calculate the annual capacity cost of any increment of capacity for peak usage and adjust that cost for safe yield or other relevant criteria. These costs can be allocated to rating periods on the basis of comparing the safe yields for different rating periods.

TABLE 4-1 (continued)

Transmission and Distribution Costs

- Treat incremental transmission investment which is related to the incremental peak load growth as a residual to ensure the equality of a revenue requirement to projected revenue collections.
- Use either linear regression or simple division so that additions in transmission and distribution are related to some measure of peak load growth.
- Use regression analysis to relate the levelized transmission and distribution sales and other costs to either off-peak, peak, administrative short-run, or variable costs.
- Use changes in transmission investment cost related to changes in peak demand.
- Relate transmission costs to a price leveled series of cost to peak demand. Distribution costs can be based on a minimum distribution system.
- Use transmission-line losses. Distribution line losses plus average of the incremental connecting charges for new customers can be calculated.
- Use embedded average cost for distribution if it is too difficult to calculate marginal distribution cost.

Source: Adapted from Stephen L. Feldman, Robert Obeiter, Michael Abrash, and Martin Holdrich, *An Operational Approach to Estimating the Marginal Costs of Urban Water Supply With Illustrative Applications* (Unpublished report to the Wisconsin Public Service Commission, October 21, 1980), 24-28.

Marginal-cost estimation in water service involves forecasting future cost and output streams. These projections require information on several variables, including technology, input price behavior, and price elasticity of water demand. In addition, a planning horizon must be specified as well as appropriate capital recovery and annuitization rates. Marginal-cost estimation is forward looking; that is, marginal operating cost, marginal capacity cost, marginal purchased water cost, and marginal customer cost involve engineering forecasts of costs incurred or avoided if usage, capacity, or the number of customers change. Finally, the marginal cost of water service varies both with time (for example, peak demand as compared with off-peak demand) and with space (for example, locational variations within the utility service area).

Naturally, the biggest difficulty in applying marginal-cost pricing is estimating marginal costs, which depends on assumptions about where the next increment of supply will come from and, of course, its cost. Several different supply options providing different increments of capacity may be available. A new well, for example, adds a much smaller increment of capacity than a new reservoir and probably at a substantially lower overall cost. However, the per-unit incremental cost of the reservoir may be lower than that of the well because of the reservoir's larger capacity. Choosing between the two supply options depends on the forecast of water demand along with hydrological and water quality considerations.

Marginal-cost theory is typically operationalized through the development of time-differentiated rates, an example of which appears in table 4-2. Although time-differentiated pricing logically flows from marginal-cost pricing, seasonal rates can be based on average or embedded cost as well as on marginal cost. In water service, the emphasis on seasonal rather than time-of-day pricing is essentially a function of water system design.[8] Distribution systems are generally designed to meet the maximum instantaneous flows anticipated from fire protection. The hourly peak demands of consumers are therefore not essential in the design of the distribution system. Thus, for most water systems there is minimal variation in

[8] Steve H. Hanke, "A Method for Integrating Engineering and Economic Planning," *American Water Works Association Journal* 71 (September 1978): 487-91.

TABLE 4-2

EXAMPLE OF MARGINAL-COST FUNCTIONALIZATION FOR DEVELOPMENT OF SEASONAL RATES

Marginal annual cost of capacity ($/mgd/year)	
Source	19,361
Treatment	0
Transmission	27,669
Distribution	12,912
Short-run costs ($/1,000 gallons)	
Electricity	0.111
Chemicals	0.010
Maintenance	0.373
Definition of peak periods	
Number of days in peak season	153
Number of peak hours per day	10
Number of peak days per week	7
Number of peak hours in peak season	1,530
Marginal cost of water ($/1,000 gallons)	
Off-peak season, all hours	
Short-run costs	0.494
Source	0.053
Total	0.558
Peak season, off-peak hours	
Short-run costs	0.494
Source	0.053
Treatment	0.000
Transmission	0.181
Total	0.743
Peak season, peak hours	
Short-run costs	0.494
Source	0.053
Treatment	0.000
Transmission	0.181
Distribution	0.203
Total	0.949
Seasonal rates ($/1,000 gallons)	
Off-peak season	0.558
Peak season	0.829

Source: Stephen L. Feldman, Robert Obeiter, Michael Abrash, and Martin Holdrich, *An Operational Approach to Estimating the Marginal Costs of Urban Water Supply With Illustrative Applications* (Unpublished report to the Wisconsin Public Service Commission, October 21, 1980), 68. Adjusted marginal prices also are reported.

incremental cost associated with daily demand cycles. Similar to the distribution system, storage capacity is determined more by fire protection considerations than by anticipated peak hour demands. Elevated storage can also partially accommodate the daily use cycle (peak and off-peak hours) as well as peak demand for transmission capacity. In contrast, major supply sources and major transmission, pumping, and treatment facilities are generally designed to meet seasonal variations in demand. For many water systems, the capacity costs of these facilities primarily reflect summer peak demands. Thus, for most water systems there is substantial variation in the incremental cost associated with their seasonal demand cycles. Regarding time-differentiated pricing in water service, the emphasis thus should be on long-term (maximum day) demand rather than on short-term (maximum hour) demand. Chapter 5 contains a more detailed discussion of seasonal rates.

Application Issues

Several obstacles can impede the effective application of marginal-cost pricing to water service. For example, Harbeson questioned whether economists actually comprehend the magnitude of divergence between estimated and theoretical marginal cost.[9] Similarly, Turvey asserted that the textbook concept of marginal cost was too simplistic to be useful.[10]

The application of marginal-cost theory in the water sector involves many tradeoffs among competing concerns.[11] The manner in which this complex set of constraints is handled in any particular circumstance depends on how marginal cost is perceived. The conclusions that may be reached will differ to the extent that different conceptions of marginal cost exist. The application of marginal-cost pricing theory to water utilities raises four general issues: (1) allocative efficiency, (2) cost and rate stability, (3) financial viability, and (4) administrative feasibility. As seen in table 4-3, each of the general application issues is associated with some specific application issues.

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9 Robert Harbeson, "A Critique of Marginal Cost Pricing," *Land Economics* 31 (February 1955): 54-74.

10 Ralph Turvey, "Marginal Cost," *Economic Journal* 78 (June 1969): 282-94.

11 Steve H. Hanke and Robert K. Davis, "Potential for Marginal Cost Pricing in Water Resource Management," *Water Resources Research* 9 (August 1973): 808-25.

TABLE 4-3

GENERAL AND SPECIFIC APPLICATION ISSUES ASSOCIATED WITH MARGINAL-COST PRICING

General Issues	Specific Issues
Allocative Efficiency	Income distribution effects Barriers to economic efficiency Ineffectiveness Competing policy goals
Cost and Rate Stability	Needle peaking and shifting peaks Distribution and customer costs Fire protection costs Purchased water costs
Financial Viability	Excess revenues Inadequate revenues Bypass Arbitrary remedies
Administrative Feasibility	Data requirements Predictive accuracy Time lags Public opposition

Source: Authors' construct.

Allocative Efficiency

Externalities pose a limitation to marginal-cost pricing theory in terms of economic efficiency. The observed willingness of consumers to pay incremental costs should not be the sole criterion for supplying them with water service. Externalities are associated with water service. For example, an external benefit that may result from the consumption of potable water is that the health of the consumer may improve with use of improved supplies; as a result, the consumer may not infect another consumer whose future health also will be enhanced. However, since the first consumer does not take the health of the second into consideration in decisions to consume water, willingness to pay incremental costs tends to understate the benefits to the community. In addition, consumers may not sufficiently understand the linkage between water quality and public health. Another example is the provision of water service for fire protection which, when afforded to one resident, also benefits neighbors by stopping the spread of fires and holding down fire insurance rates. Consumers may not understand implicitly the linkage between water service reliability and fire protection.

With respect to output, costs tend to be marginal only intermittently, depending on system utilization. If water system capacity is less than fully utilized, the only costs immediately attributable to additional water usage are certain operating costs (including the cost of purchased water). These costs are referred to as short-run marginal cost (SRMC). Long-run marginal cost (LRMC), in contrast, refers to the sum of SRMC and marginal capacity cost (MCC)--the cost of extending capacity to accommodate additional usage. The two definitions of marginal cost--one applicable in the short run and the other in the long run--must be reconciled since a pricing policy which is associated with the efficient use of existing capacity can result in nonoptimal investment decisions, and vice versa.

Strictly interpreted, the marginal-cost approach requires that price equal SRMC when capacity is not fully utilized, but, as full capacity utilization is attained, price should be increased to ration existing capacity. Once a capacity increment is completed, price should fall again to SRMC, for then the only real incremental costs are operating costs. In brief, prices theoretically should be increased with increasing demand in the period before a capacity increment is necessary; then when the capacity increment becomes available (and excess capacity exists), prices should be decreased, as illustrated in figure 4-2.[12] Water price, therefore, has the twin objectives of (a) attaining an efficient allocation of resources when the system is operating at less than full capacity, and (b) providing signals for when to invest in additional capacity.[13]

Some analysts have addressed the "second best" problem; that is, the issue of marginal-cost pricing not necessarily being optimal for the water sector given significant divergences from optimal pricing and optimal resource allocation in other sectors of the economy.[14] Marginal-cost pricing in one sector may still produce allocative inefficiency if the remaining sectors (through monopoly, taxation, and so on) have prices unequal to marginal cost. Water itself is not priced systematically in each of the major use sectors--agriculture, industry, and public supply. Allocation problems may be particularly apparent during periods of drought or when water supplies are otherwise impaired. Finally, allocative efficiency may not be achievable if other policy goals--such as equity--take precedence.

In addition, some specific application issues related to allocative efficiency include income distribution effects, barriers to economic efficiency, ineffectiveness, and competing policy goals. First, marginal-cost pricing, as with any pricing scheme, has distributive effects on income, a public policy consideration that will generally arise in its implementation. Second, the anticipated economic efficiency gains from marginal-cost pricing may not materialize if, for example, technical or cost efficiencies are not achieved. Moreover, these efficiencies will remain elusive given deviations from efficient pricing in other sectors of the economy, including water use sectors other than public supply. Third, implementation of marginal-cost pricing through seasonal rates or other rate structures may have little or no effect on water consumption patterns which will be a disappointment for those who seek to use the rate structure to induce operational changes, such as load factor improvement. Fourth, policy goals other than allocative efficiency, such as affordability and equity, play a role in cost allocation and rate design.

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12 William Goolsby, "Optimal Pricing and Investment in Community Water Supply," *American Water Works Association Journal* 67 (May 1975): 220-24.

13 William Vickrey, "Responsive Pricing of Public Utility Services," *Bell Journal of Economics* 2 (Spring 1971): 337-46.

14 William Vickrey, "Some Implications of Marginal Cost Pricing for Public Utilities," *American Economic Review* 45 (May 1955): 605-620; and Robert Harbeson, "A Critique of Marginal Cost Pricing," *Land Economics* 31 (February 1955): 54-74.

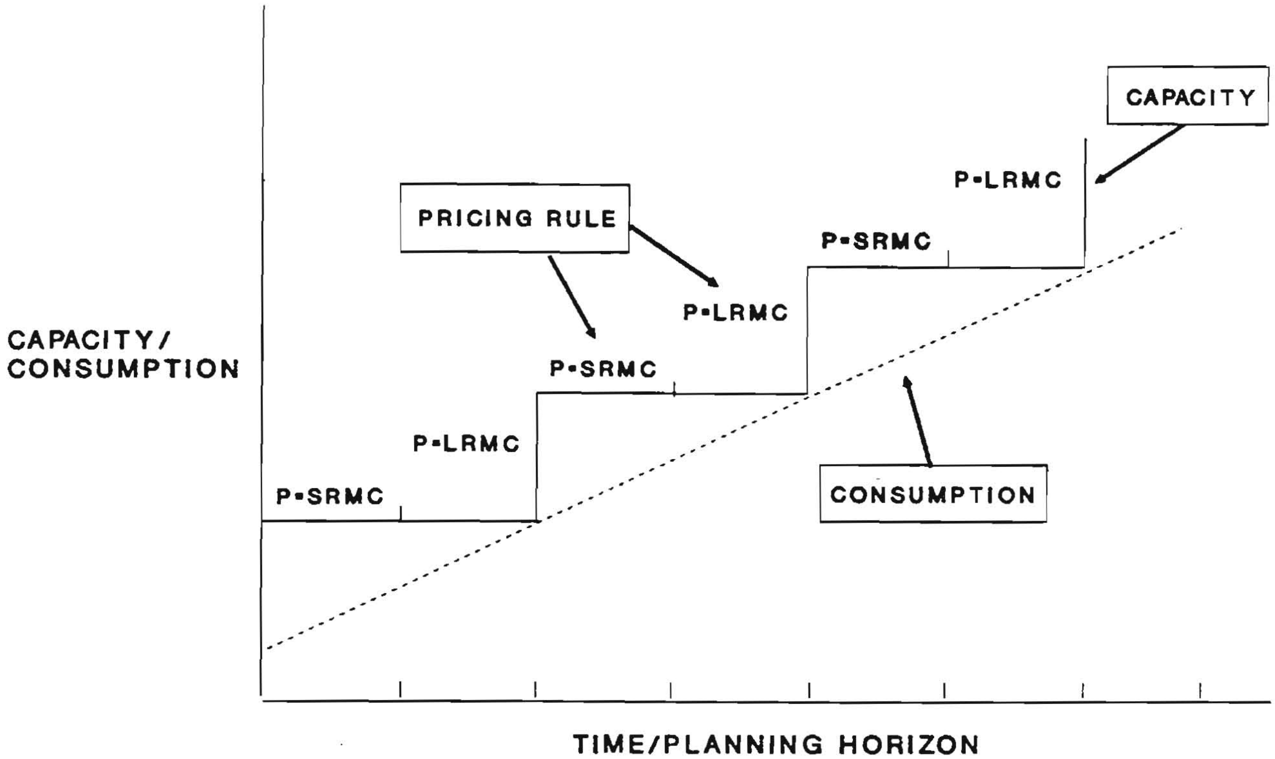

Fig. 4-2. Long-run marginal cost (LRMC) and short-run marginal cost (SRMC) pricing applications for lumpy capacity additions.

Cost and Rate Stability

Cost and rate stability problems associated with strict application of marginal-cost pricing theory are especially apparent in the presence of capital indivisibility (also known as investment "lumpiness"), meaning that capacity is typically added in large increments, some of which have a relatively long service life. By contrast, the rate of capacity utilization changes gradually. In fact, lumpiness is a trait that can apply to operation and maintenance expenses as well, perhaps especially for very small systems.[15] The indivisibility condition is particularly applicable to new water authorities which have a relatively small existing capital stock, and in which large investments are required to place a central system into full operation. Given initial capacity costs which are high relative to operation costs, strict marginal-cost pricing (as well as the strict use of embedded costs) will result in significant fluctuations in price creating a considerable source of uncertainty for consumers and creating problems (including rate shock) both for water utility managements and regulators. Even where it is technologically possible to extend capacity in relatively small increments, fluctuations in financing availability may result in capacity being extended in large increments. The exception is the already established water system with its large existing capital stock; in this case, if demand increments are relatively small and systematic, the indivisibility problem can be minimal.

Another aspect of capital indivisibility is found in the water distribution network. Prior to its construction, distribution costs would be characterized as incremental costs. However, the distribution network is generally designed to meet demands placed upon it for many future years, during which time additional usage causes negligible incremental distribution capacity costs. Economic theory suggests that the price charged for this element of service also should be negligible. This, however, presents a conflict between economic efficiency and the financial viability of the water utility.

Some specific application issues related to cost and rate stability are needle peaking and shifting peaks, distribution and customer costs, fire protection costs,

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[15] Contrast, for example, the addition of another licensed operator to a small one-operator system as compared with a system already employing ten operators (all with comparable salaries, etc). Relative expenses would increase by 100% to the small system and by only 10% to the larger system.

and purchased water costs. First, for a summer-peaking utility (because of lawn sprinkling), peak demand may not be substantially reduced by seasonal pricing, even though average demand declines. Results include the deterioration in annual load factors and revenue erosion. Seasonal rates may induce consumption that shifts the time of peaks but not their overall magnitude. Second, unstable rates can result from inappropriate cost allocation rules. Distribution costs (which vary with main size, number of customers, and location of mains) and customer costs (which are independent of capital expansion) can be handled through service charges. Third, capacity increments may or may not include capacity for meeting fire flow requirements. The joint nature of water service for consumption and fire protection makes it difficult to calculate the marginal cost of fire protection; thus, there has been a tendency to avoid the calculation of marginal fire protection cost. Fourth, the calculation of marginal costs should fully account for wholesale purchases of treated or untreated water.

Financial Viability

The strict application of marginal-cost pricing theory will result in insufficient revenues to the water utility if average cost exceeds marginal cost and excess revenues if average cost is less than marginal cost. In other words, marginal-cost pricing may lead to a mismatch of costs and revenues. This is one of the chief concerns about the marginal-cost pricing approach expressed by the American Water Works Association.[16] Accordingly, "it may be necessary to structure customer charges to achieve a balance of revenues and costs or to diverge from marginal-cost pricing somewhat" in order to align costs and revenues.[17] Of course in doing so, the economic efficiency gains of the marginal-cost pricing method may be lost. There is also concern that high prices will lead to consumption reductions that in turn reduce revenues and threaten the financial viability of the water utility. For these reasons, it may not be possible to achieve the most efficient allocation of water supplies.

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16 American Water Works Association, *Water Rates* (Denver, CO: American Water Works Association, Manual M1, Third Edition, 1983), 57.

17 Mark Day, "A Discussion of Empirical Evidence of the Conservation Impact of Water Rates," in Arizona Corporation Commission, *Water Pricing and Water Demand* (1986): 38.

Some specific financial viability issues that are in the implementation of marginal-cost pricing include excess revenues, inadequate revenues, bypass, and arbitrary remedies. First, water rates set equal to marginal cost may generate revenues in excess of revenue requirements for the water utility, primarily because historical accounting costs tend to underestimate the actual value of resources. Second, if prices based on marginal costs are below prices based on average costs, utility revenues will be inadequate. In particular, utilities with plentiful capacity may have difficulty recovering costs under marginal-cost pricing. Third, confronted with higher water rates, and based on price elasticities for water demand, some large industrial and commercial customers may bypass the local water utility in favor of self supply, which may have adverse effects on the utility's revenue stream. Fourth, methods to treat the problems of excess revenues, inadequate revenues, and bypass can be arbitrary and atheoretical, and many produce ambiguous price signals that undermine the potential for efficiency gains. Subsidization (in either direction) is more likely when revenues do not match costs.

Administrative Feasibility

Sophisticated analyses of utility costs require substantial resources for data collection and cost calculation, affecting both utilities and their regulators. There are measurement difficulties associated with the way cost data are collected and stored in utility accounting systems and with the higher metering and administrative costs required for the collection of certain types of data. Long-run marginal-cost estimations are highly subjective and the use of large data bases and elaborate calculations may not always improve decisionmaking by utilities and their regulators.

There is also the possibility that a well-executed average-cost pricing methodology will result in a close approximation of marginal costs, and do so in a simpler, more understandable way. In fact, some fully distributed cost studies may look much like marginal-cost studies. Decisionmakers may prefer the status quo analysis of historical costs, particularly if it is perceived to be less costly. The problem is in deciding whether the benefits of using marginal-cost analysis--including efficiency gains--outweigh these administrative costs.

Some specific application issues related to administrative feasibility include: data requirements, predictive accuracy, time lags, and public opposition. First, cost analysis requires substantial, accurate cost and demand data. Further, a rate structure can be no more sophisticated than the capability of measuring the water consumption to which the rate structure is applied. Thus water metering is essential and changes in cost accounting and billing practices may be necessary as well. Second, the cost forecasting necessary for marginal-cost estimation is imprecise and alternative calculation techniques yield different results. The approach also requires reliable data on the price elasticity of peak water demand. Without reliable elasticity estimates, price changes will have uncertain effects on revenues, load factors, operation costs, and capacity requirements. Third, billing cycles and time lags between the occurrence of peak demands, meter reading, and the customer's receipt of the water bill increase the uncertainty of consumer response to price. Fourth, the public and regulators may have difficulty accepting a radical change in the establishment of water rates, particularly if consumers perceive that a new rate structure is inequitable, unaffordable, or confusing.

Most of these application problems can be addressed, if not resolved. For example, probably the most problematic issue is the potential for marginal-cost pricing to result in excess revenues for the water utility. Stephen Feldman and his colleagues proposed several alternative tactics for addressing this problem.[18] One could decide not to reconcile the resulting rates with the revenue requirement. Assuming this is not desirable, costs can be adjusted while maintaining peak to off-peak ratios. Alternatively, marginal-cost components (short-run and long-run) can be adjusted proportionately. Overcollections can be rebated or taxed. Intramarginal discounts can be used to lower rates. Rates also could be adjusted by treating distribution cost as a residual. Finally, the inverse elasticity rule can be used in rate design to treat different customer classes differently (Ramsey pricing).

In sum, the application of marginal-cost pricing involves substantial problems, complicating its implementation. Interestingly, however, opponents of marginal-cost pricing stress these conceptual and applicational problems, rather than the possible superiority of conventional average-cost pricing. Many analysts recognize that the problems associated with marginal-cost pricing also apply to average-cost pricing. Of course, analysts' judgment plays a role in any method.

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[18] Stephen L. Feldman, Robert Obeiter, Michael Abrash, and Martin Holdrich, *An Operational Approach to Estimating the Marginal Costs of Urban Water Supply with Illustrative Applications* (Unpublished report to the Wisconsin Public Service Commission, October 21, 1980), 28.

However, conceptual and applicational problems should not stifle ratemaking innovation. Perhaps the most serious difficulty in using marginal-cost pricing lies not in the theory itself or even in the calculation of marginal costs but in the actual translation of cost estimates into water rates. The potential beneficial effects on costs, price stability, and economic efficiency under a marginal-cost or incremental-cost approach would appear to tip the scales in favor of considering including this approach among other tools of the trade.

Four Formulations of Marginal Cost[19]

Most definitions of marginal cost are similar in that they are forward looking; that is, they focus on immediate and near-term-future costs and output. Definitions differ in the extent to which they stress the importance of short-run as opposed to long-run costs, operation as opposed to capacity costs, and changes in consumption in different time periods. Thus, the definitions vary to the extent to which they focus on short-run versus long-run allocative efficiency and by the extent to which they attempt to minimize price fluctuations. Four marginal-cost formulations are discussed below:

- Simple Marginal Cost (SMC)
- Textbook Marginal Cost (TMC)
- Turvey Marginal Cost (TVMC)
- Average Marginal Cost (AMC)

All four formulations are presented for completeness, but while the first two lay the foundation for marginal-cost pricing, severe weaknesses preclude their application in the regulatory context. The other formulations are less true to pure economic theory but more pragmatic.

[19] See also, Patrick C. Mann, Robert J. Saunders, and Jeremy J. Warford, "A Note on Capital Indivisibility and the Definition of Marginal Cost," *Water Resources Research* 16 no. 3 (June 1980): 602-4.

Simple Marginal Cost

Simple marginal cost (SMC) is defined as:

$$SMC_t = \frac{(R_t - R_{t-1}) + I_t}{(Q_t - Q_{t-1})}$$

where: t = the year for which the calculation is being made,
R = operating and maintenance expenditures,
I = capital investment becoming operational, and
Q = water output.

If capacity increments are uneven, SMC generates cost estimations having significant volatility; thus the primary objection to this particular definition of marginal cost is that it precludes any averaging of future capacity increment. In this context, the remaining three formulations of marginal cost incorporate varying degrees of averaging or "smoothing" capital expenditures. It is stressed here that SMC, and similar formulations which focus primarily on short-run marginal cost, cannot be considered as practical cost estimation methods for water service. In brief, SMC, by focusing on the short-run, essentially fails to recognize the averaging of capacity increments, and the desirability of averaging to meet certain regulatory objectives.

Textbook Marginal Cost

Textbook marginal cost (TMC) consists of two components: short-run marginal cost (SRMC), reflecting operating cost increments, and marginal capital cost (MCC), reflecting capital expenditure increments. Similar to SMC, TMC reflects a relatively short planning horizon. TMC is defined as:

$$\begin{aligned} TMC_t &= SRMC_t + MCC_t \\ &= \frac{(R_t - R_{t-1}) + rI_t}{(Q_t - Q_{t-1})} \end{aligned}$$

where: r = the capital recovery factor or the annual payment that would repay a unit loan over the economic life, n years, of the capital expenditure with compound interest of i on the unpaid balance; that is:

$$r = \frac{i\,(1+i)^n}{(1+i)^n - 1}.$$

Given uneven capacity increments, TMC reflects both SRMC and MCC in the years in which capacity becomes operational and reflects only short-run marginal costs in the years in which no capital investment becomes operational. TMC, therefore, generates cost estimations exhibiting substantial fluctuations. However, the application of the annuitization factor (r) to capital expenditures produces some averaging of capacity costs.

Turvey Marginal Cost

Turvey marginal cost (TVMC) is an estimation method advocated by Ralph Turvey for application in water supply.[20] Similar techniques have been advocated for application to electric utilities.[21] TVMC can be defined as the present worth of the cost increment resulting from the same permanent increment in demand starting at the beginning of year t-1 *minus* the present worth of the cost increment resulting from the same permanent increment in demand starting at the beginning in year t. That is, TVMC reflects the difference in the present values of the future cost streams by shifting (for example, postponing or accelerating) a specified capacity increment by one year. The focus is not on the total costs of capacity expansion but on the cost effects of postponement or acceleration of expansion. In this context, marginal cost is the cost saving from postponing a capacity increment and not the cost saving from abandoning the capacity increment entirely.

TVMC considers marginal capacity costs with marginal operating costs defined as annual operating cost divided by the annual amount of water consumption. TVMC differs from the textbook conception of marginal cost in that it varies both

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[20] Ralph Turvey, "Analyzing the Marginal Cost of Water Supply," *Land Economics* 52 (May 1976): 158-68.

[21] Charles J. Cicchetti, William J. Gillen, and Paul Smolensky," *The Marginal Cost and Pricing of Electricity* (Cambridge, MA: Ballinger Publishing Company, 1977).

upward and downward and is positive only in those years when demand is at or near existing capacity; in between capacity increments, TVMC is generally zero. TVMC is affected when capacity increments are pushed forward or backward in time. Given an increment to projected demand growth, TVMC measures the effect on the present value of total system costs from the acceleration in capacity expansion. Given a decrement to projected demand growth, TVMC measures the effect on the present value of total system costs from the postponement in capacity expansion. In brief, TVMC reflects the difference in total system costs caused by changes in projected permanent demand growth. The TVMC method does not generally look beyond the next capacity increment; thus it ignores the effect of changing unit costs associated with subsequent changes in output. It does, however, incorporate an adjustment for system water loss.

Hanke developed marginal-cost estimates employing a version of TVMC.[22] In his calculation, MCC for a specific year y equals the present worth in y of planned system costs associated with the incremental annual demand starting in year y *minus* the present worth in y of planned system costs with the increment in annual demand starting in year y + 1, divided by the annual increment in usage. Thus, marginal capital cost is calculated on the premise of a postponement in capacity expansion. Total marginal cost is the composite for marginal capital costs and marginal operating costs (projected operation costs divided by projected annual water usage). To calculate marginal capital costs for annual use, the relevant capacity investment is aggregated; to calculate costs on a seasonal basis, the relevant planned investment are disaggregated into summer capacity and winter (base) capacity.

Average Marginal Cost

Average marginal cost (AMC) can be viewed as an attempt to reach a compromise between short-run allocative efficiency and the need for correct capacity investment signals by going beyond the traditional definition of the long run by including all future capital expenditures for a specified planning period. Of course, the longer the time frame, the greater the uncertainty of the capital cost

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22 Steve H. Hanke, "On the Marginal Cost of Water Supply," *Water Engineering and Management* 120 (February 1981): 60-63, 69.

estimates. Given its emphasis on a planning horizon, AMC avoids the problem of defining the magnitude of the very next capacity increment, which is invariably difficult to specify, particularly for large water systems in which several different capacity investments may become operational simultaneously.

Mann, Saunders, and Warford presented a relatively sophisticated version of AMC labeled as average incremental cost (AIC).[23] In essence, AIC is calculated by discounting the future incremental costs which will be incurred in providing the incremental water demanded and dividing that by the discounted value of incremental water output over the planning period, as follows:

$$\text{AIC} = \frac{\text{Present worth of the least-cost investment stream}}{\text{Present worth of the incremental output stream resulting from the capacity investment}}$$

Hanke presented a somewhat more pragmatic version of average marginal cost.[24] Capital expenditures are categorized into those capacity increments associated with water volume (such as treatment plants, service reservoirs, trunk mains, and source of supply facilities) and those not associated with water volume (such as distribution mains, meters, and customer services). The latter capital expenditures are primarily related to the number of customers served and should not be included in marginal capital cost calculations to be used as a basis for commodity charges; they are more appropriate for connection and service charges. Since investment increments often change abruptly, the capacity increments are averaged over several years. Therefore, marginal capital cost is formulated as the annuitized value of planned capacity expenditures becoming operational divided by the forecasted increment in total water usage for the planning period (say, five years). Marginal operation and maintenance costs are categorized into those related to volume and those not related to volume and are also averaged over the planning horizon. The resulting average marginal cost, then, consists of averages for both capital costs and the appropriate operation and maintenance costs.

The AMC method recognizes that different increments of capacity have different life spans. It also provides cost estimates that reflect future cost trends

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23 Mann, Saunders, and Warford, "A Note on Capital Indivisibility."

24 Steve H. Hanke, "A Method for Integrating Engineering and Economic Planning," *American Water Works Association Journal* 71 (September 1978): 487-91.

to be incurred as water usage changes. Finally, the method recognizes that with capacity increment lumpiness and the associated abrupt changes in operating costs when capacity increments become operational, it is essential that both capacity and operating costs be averaged over a specified planning period. Given the nature of its averaging process, AMC tends to generate cost estimates that exceed short-run marginal costs but that are less than long-run marginal costs in the TMC formulation. AMC generates cost estimates that smooth out capital expenditures while reflecting the trend of future costs that will be incurred as usage increases.

Hanke also suggested a modified cost categorization in calculating marginal capital costs.[25] He divided capacity costs into those associated with facilities designed to meet maximum-day demand (such as treatment plants), those related to average-day demand (such as reservoirs), and those related to customers and population growth (such as meters). Marginal capital cost in this case consists of separate components for supplying maximum-day demand and average-day demand. In essence, one can calculate peak and off-peak marginal capital costs according to these components. This categorization is important if there is substantial cost variation over the annual demand cycle, which could justify seasonal water rates. If consumers are to receive correct price signals, then the peak period should involve a price reflecting peak and off-peak costs; the off-peak price should reflect only off-peak costs. Hanke and Smart extended marginal-cost analysis to incorporate a demand simulation model.[26] Such models are useful in projecting consumer responses to changes in rate design, such as the implementation of a uniform rate based on marginal cost or seasonal rates based on peak and off-peak marginal costs.

Feldman, Breese, and Obeiter offer another version of average marginal cost.[27] Their version incorporates the calculation of the marginal costs of source capacity, transmission capacity, distribution capacity, treatment capacity, as well as marginal

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25 Steve H. Hanke, "Water Rates: An Assessment of Current Issues," *American Water Works Association Journal* 67 (May 1975): 215-19.

26 Steve H. Hanke and A. C. Smart, "Water Pricing as a Conservation Tool: A Practical Management Option," in *Environmental Economics* (Canberra, Australia: Australian Government Publishing Service, 1979).

27 Stephen L. Feldman, John Breese, and Robert Obeiter, "The Search for Equity and Efficiency in the Pricing of A Public Service: Urban Water," *Economic Geography* 57 (January 1981): 78-92.

operating cost. As with other marginal-cost methods, the data employed in the calculations are engineering's best estimates. Customer costs are excluded from the analysis because they are presumed to be unchanged with system expansion. Finally, in this version, marginal costs are adjusted upward for system water losses.

Evaluating Estimation Techniques

In the abstract, marginal cost is a simple concept. In practice, different definitions of marginal cost exist. The version selected for actual implementation may be determined by factors such as the size of the projected demand increment, the relevant planning horizon, data availability, the preference for short-run allocative efficiency as opposed to long-run resource allocation, the potential impact of technology on production costs, the extent to which price stability is desired, prevailing prices, and the revenue consequences of each particular formulation of marginal cost.

The definitions of marginal cost described above cover the spectrum of tradeoffs among most of these factors. For example, even though TMC is the method that adheres most strictly to theoretical marginal cost, in certain cases both it and SMC can be rejected on technical grounds because they incorporate an insufficient planning horizon (therefore providing inadequate price signals to water consumers regarding the marginal capital cost of water service). The two methods can also be rejected on practical grounds since the potential price volatility associated with each creates regulatory, political, as well as administrative and financial management problems for the water utility. TVMC and AMC are marginal-cost formulations which average the costs of capacity expansion; that is, they incorporate marginal capital cost in price even when capacity increments are not imminent. AMC and TVMC incorporate a longer view of water costs than do SMC and TMC, thus minimizing cost-price fluctuations.

A framework is essential for selecting the most appropriate marginal-cost definition for any particular application. As discussed above, four essential evaluation criteria are:

- Allocative efficiency
- Cost and rate stability
- Revenue adequacy
- Administrative feasibility

The first criterion involves the issue of which marginal-cost definition will satisfy the criterion of minimum divergence from textbook marginal cost (TMC), which represents an approximation of a price that induces short-run allocative efficiency and correctly signals the justification of capacity increments. TMC may not be an absolute representation of marginal cost as defined in economic theory, but it does approximate the theoretical specification of marginal cost. This criterion implies that alternative methods be examined for both absolute differences and ratios between their marginal-cost estimations and comparable TMC estimations. One anticipates that the alternative formulations will tend to converge toward TMC as the capital investment pattern becomes smoother. Even if one does not accept economic efficiency in the broadest sense as a reasonable policy goal, the choice of a marginal-cost pricing method can bring about improvements in price and investment signals as well as the development of a practical cost estimation tool.

The second criterion involves the issue of which marginal-cost definition will best satisfy the criterion of minimizing the volatility of estimations; that is, which technique tends to generate cost estimations having the property of relative stability even under conditions of extreme lumpiness in capacity investment. This criterion implies that marginal-cost estimations be examined for properties of direction (behavior patterns), magnitude, and volatility. This criterion recognizes that marginal-cost pricing has not been feasible in some cases since, under conditions of lumpy investment, prices can be extremely volatile creating both political and financial management problems.

The third criterion concerns the issue of which marginal-cost definition will best satisfy the criterion of providing adequate revenues to cover revenue requirements; that is, which technique minimizes the potential for revenue erosion as well as excess revenues. This criterion indicates that the estimation methods be examined for the property of revenue flows and whether those flows will match incurred costs or revenue requirements.

The fourth criterion is administrative feasibility. The operationalization of marginal costs can be more or less complex. Some of the more sophisticated approaches may be closer to the textbook ideal and yet be very costly to implement. In some cases, the cost of generating data may outweigh the benefits, even the efficiency gains, of the marginal-cost method. A related point is that customer confusion about changes in rate design may create administrative and regulatory problems for the water system. On the other hand, administrative costs are associated with all methods.

The relative importance of the four criteria is essentially a function of judgment. For example, since the typical sale of water is in the nature of a short-term agreement, those who advocate prices based on short-run marginal cost accept price volatility as less important than economic efficiency. That is, the potential exists for continually changing water prices. However, a rational pricing scheme cannot incorporate one criterion such as efficiency and totally ignore price stability and financial considerations. Conversely, a rational pricing scheme cannot incorporate price stability and adequate revenue generation and overlook allocative efficiency as a relevant consideration.

The selection of one definition of marginal cost results in accepting various tradeoffs among allocative efficiency, cost and rate stability, revenue adequacy, and administrative feasibility. The magnitude and nature of these tradeoffs will vary with investment conditions, price horizons, capital recovery factors, economies of scale, and system growth. The ambiguous nature of the marginal-cost concept permits significant latitude in its actual estimation with the outcome being cost estimates diverging from theoretical marginal cost. For example, the averaging process implicit in the average marginal cost and Turvey marginal-cost formulations, even though desirable, can produce cost estimates having little resemblance to the marginal-cost concept portrayed in microeconomic theory. In sum, there are several ways in which marginal cost can be defined for pricing purposes, each having theoretical and practical disadvantages as well as advantages.

Incremental Least-Cost Analysis

The development of a marginal-cost method for application in water is made easier with the use of an appropriate policy framework. Proposed here is a method for calculating average incremental costs that builds substantially on the estimation techniques discussed above while incorporating several practical solutions to some of the more troublesome conceptual and application problems. The general steps in the incremental least-cost (ILC) approach are compared with a marginal-cost pricing approach in table 4-4.

The proposed ILC method defines the next increment of capacity in terms of least-cost planning criteria. The rationale is that cost allocation and rate design

TABLE 4-4

COMPARISON OF MARGINAL-COST ANALYSIS AND INCREMENTAL LEAST-COST ANALYSIS

Key Steps in a Marginal-Cost Analysis

STEP 1: Identify all potential supply options.

STEP 2: Choose the most viable supply option.

STEP 3: Develop cost-allocation assumptions and methodology.

STEP 4: Perform the cost estimation for the most viable supply option.

STEP 5: Use the cost estimation in rate design.

Key Steps in an Incremental Least-Cost Analysis

STEP 1: Identify all potential supply options <u>using planning criteria</u>.

STEP 2: Develop cost-allocation assumptions and methodology.

STEP 3: Perform the cost estimation <u>for each supply option</u>.

STEP 4: Choose <u>the most viable least-cost supply option</u>.

STEP 5: Use the cost estimation in rate design <u>and planning</u>.

Source: Authors' construct

are an integral part of supply planning and such a methodology helps reinforce these relationships. A planning approach confines the number of capacity increment alternatives to those that meet a priori planning criteria within a specified planning time frame. Planning criteria need not be confined to least-cost principles or even to cost considerations. For example, most water supply plans would require systems to maintain basic engineering and health standards related to system reliability and water quality where cost is a subordinate consideration. The planning framework can span any length of time, and potential capacity increments can be either small or large and have either a short or long service life. One need not assume that the next capacity increment will be added within the next year or even in the next few years. Absent a highly technical analysis, water system engineers essentially can make an educated forecast about a select number of potential capacity sources.

Methodology

The incremental least-cost methodology is summarized in table 4-5. The first step is the identification of appropriate supply alternatives (including changes in output levels using existing capacity as well as nontraditional supply options) consistent with relevant planning criteria. Each supply increment will involve different types of costs in the different functional areas of public water supply: source development (including raw water storage), pumping, transmission, treatment, and storage (for treated water). Some options, such as purchased water, require a separate functional category. Which cost categories are affected by each option depends on the system's existing capacity configuration. Some, for example, may entail additional incremental costs in only select areas without affecting costs in others.

TABLE 4-5

STEPS IN AN INCREMENTAL LEAST-COST ANALYSIS

- Identification of incremental capacity alternatives.
- Feasibility analysis of incremental capacity alternatives.
- Estimation of capital and operation and maintenance costs.
- Cost allocation to functional categories of water supply.
- Cost allocation to off-peak and peak demand.
- Cost allocation to service classes.
- Calculation of total annualized incremental costs (TAIC).
- Calculation of average incremental costs (AIC).
- Identification of incremental least-cost (ILC) alternative.
- Use of estimates in rate design and planning.

Source: Authors' construct.

For purposes of comparison, the incremental capital costs (k) associated with each supply alternative are operationalized as the annual payment over the useful service life of the capital expenditure necessary to pay interest and fully recover capital costs, as follows:[28]

$$k = \frac{Ci(1 + i)^n}{(1 + i)^n - 1}$$

where:
- k = annualized capital costs,
- C = the total capital expenditure required,
- n = the useful service life of the capital expenditure (a proxy for the consumer payback period), and
- i = the appropriate interest (financing) rate.

For each capacity alternative, the analyst must also estimate operation and maintenance expenses (OM). A pragmatic approach is to use the projected annual OM for the first year that the capacity addition is expected to be operational. Knowing both k and OM for each option allows the calculation of total annualized incremental costs (TAIC) for each capacity option according to the general formula:

$$TAIC = k + OM.$$

Allocating costs to each of the identified functional areas of water supply yields the more detailed formula:

$$TAIC = (k+OM)_d + (k+OM)_p + (k+OM)_r + (k+OM)_t + (k+OM)_s + (k+OM)_o$$

where:
- k = annualized capital costs,
- OM = additional annual operation and maintenance costs,
- d = source development,
- p = pumping,
- r = transmission,
- t = treatment,
- s = storage, and
- o = nontraditional supply.

[28] Jack Hirshleifer, James C. Dehaven, and Jerome W. Milliman, *Water Supply: Economics, Technology, and Policy* (Chicago: University of Chicago Press, 1960).

This calculation of TAIC can be performed for unallocated additions to system capacity, for additions that meet off-peak or peak capacity needs, or for capacity requirements for different customer classes (which also may be divided into off-peak and peak needs). Analysts must develop allocation rules for the assignment of costs. Although in theory all costs can be allocated to a functional area of water supply, some analysts may choose to use a separate category for joint or common costs, such as general office expenses. The customer categories that apply depend on characteristics of the water service area. Cost allocation can be facilitated by the use of an incremental cost allocation matrix, an example of which appears in table 4-6.

The next step in the analysis is the choice of an appropriate denominator for comparing costs on a per-unit basis in terms of what is known as average incremental cost (AIC). Some of the available alternatives are summarized in table 4-7. As always, analyst judgment plays an important role. One approach is to calculate AIC by dividing simple annual costs (TAIC) by the amount of designed capacity added in millions of gallons per annum (mg):

$$AIC_{mg} = \frac{TAIC}{W_{mg}}$$

where: W = additional increment of water capacity, and
mg = million gallons per annum.

The problem with this formulation of AIC is that it does not take into account the difference between designed capacity and utilized capacity or the magnitude of water losses. As a result, AIC_{mg} may tend to underrepresent unit costs. An alternative denominator can be used to reflect the expected utilization of the capacity increment. A utilization factor is the ratio of the maximum demand of a system to the installed capacity of the system. Thus, an alternative AIC calculation can be represented by:

$$AIC_{umg} = \frac{TAIC}{u * W_{mg}}$$

where: u = utilization factor for the capacity increment.

TABLE 4-6

INCREMENTAL COST ALLOCATION MATRIX

Functional Areas		Total Incremental Costs	Allocation of Costs to Demand		Allocation of Costs to Service Classes by Demand														
					Residential		Commercial		Industrial		Wholesale		Institu-tional		Public Authorities		Fire Protection	
			Base	Peak	Base	Peak	Base	Peak	Base	Peak	Base	Peak	Base	Peak	Base	Peak	Base	Peak
Source Development	k																	
	OM																	
	k+OM																	
Pumping	k																	
	OM																	
	k+OM																	
Transmission	k																	
	OM																	
	k+OM																	
Treatment	k																	
	OM																	
	k+OM																	
Storage	k																	
	OM																	
	k+OM																	
Nontraditional Supply	k																	
	OM																	
	k+OM																	
Total incremental cost*																		

* Assumes allocation of general plant, administration, joint/common, and other costs.

TABLE 4-7

NOTATION USED IN CALCULATING AVERAGE INCREMENTAL COSTS

Notation	Definition
k	Incremental capital costs (annualized).
OM	Incremental operation and maintenance costs (annualized).
$k+OM$	Total annualized incremental cost (TAIC).
$\frac{k+OM}{W_{mg}}$	Average incremental cost (AIC) per system design capacity.
$\frac{k+OM}{u * W_{mg}}$	Average incremental cost (AIC) per utilized capacity, where u = a utilization factor based on system output.
$\frac{k+OM}{W_{rpmg}}$	Average incremental cost (AIC) per revenue producing water.
$\frac{k}{W_{mg}} + \frac{OM}{u * W_{mg}}$	An average incremental cost (AIC) hybrid where unit capital costs are based on added design capacity and unit O&M costs are based on output using a utilization factor.

Source: Authors' construct.

There is another approach for dealing with the issue of water losses, water that is provided free-of-charge, or otherwise unaccounted-for water. Caused by a variety of conditions, "nonaccount water" is not billed and therefore generates no revenues for the utility.[29] The greater the system water loss, the more AIC will underestimate the actual incremental cost of water. Although historical records can be used, care should be taken in estimating revenue producing water because water losses do not necessarily increase linearly with output. Given an estimate of expected annual revenue producing water (rpmg), another calculation of AIC can be made as follows:

$$AIC_{rpmg} = \frac{TAIC}{W_{rpmg}}$$

where: rpmg = revenue producing million gallons per annum.

It follows that the incremental cost of water losses can be estimated by calculating the difference between the incremental cost of the gross additional increment of capacity and the incremental cost of revenue producing capacity. Because mg is always greater than rpmg, this number will always be positive. Water system managers and their regulators will certainly take note of the magnitude of this amount. For some utilities, leak detection and repair may itself be a cost effective (if not least cost) source of additional capacity. Indeed, the incremental least-cost method incorporates a variable (o) to address this potential source of supply. Other supply options, such as purchased water and conservation programs, also can be considered in the nontraditional category, as long as their cost impacts on other functional areas (such as transmission and distribution) also are identified.

Assuming that AIC is calculated for more than one potential source of additional capacity, incremental least cost (ILC) is simply the lowest value that results from the comparative analysis. The option identified should be reanalyzed in terms of feasibility and desirability. If the least-cost alternative is not preferable, it is incumbent on the analyst to explain why. Finally, the least-cost estimate should be compared with cost estimates using other methodologies, including traditional methods used to determine revenue requirements. The divergence

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29 On the issue of water losses, see Lynn P. Wallace, *Water and Revenue Losses: Unaccounted-For Water* (Denver, CO: American Water Works Association, 1987).

between estimates should be evaluated with care, particularly if the analysis is used for pricing decisions.

Assumptions

It is important to clarify the several assumptions underlying the application of the incremental least-cost method described here. These apply to other approaches as well and may present application limitations when certain conditions cannot be assumed. First, it is assumed that operating and cost data on potential supply capacity increments (including changes in existing levels of output) are either readily available or can be easily estimated. Second, operating and cost data on nontraditional supply alternatives, such as wholesale purchases, source-of-supply leasing, leak detection and repair, conservation technology, and so on, can also be estimated. Third, service lives and financing rates associated with alternative capacity increments can be identified with reliability. Fourth, reasonable estimates can be made of the amount of water capacity added to the water system as well as revenue producing water and unaccounted-for water. Fifth, the cost of incremental additions to the distribution system can be directly recovered and therefore are not properly included in a marginal-cost analysis. Sixth, it is assumed that the water utility experiences a positive growth rate in water output and usage along with increased costs of service during the planning period. This assumption precludes the generation of negative marginal-cost values that can occur under this and other cost calculation techniques.

Perhaps most importantly, similar to the average marginal-cost method previously discussed, it is assumed that the use of the incremental least-cost method as described places more importance on the evaluative criteria of cost and rate stability, revenue adequacy, and administrative feasibility than on the criterion of economic efficiency. The method is principally a least-cost planning and general ratemaking tool, and one that should be used in conjunction with others available to the analyst, including historical cost studies.

Discussion

An important part of the ILC method is that incremental capital and operation costs are estimated for each potential capacity increment on an annualized basis. Average incremental costs can be calculated by determining annualized costs and dividing this amount by the amount of capacity added. Capital and operating costs can be estimated separately for each of the principal cost categories (that is, source development, storage, transmission, treatment, and so on) and, at the analyst's discretion, separately for capacity needed to meet off-peak and peak demand. The analysis can be taken a step further by estimating these costs for different customer classes. Still, the method does not require more data than most other cost allocation analyses.

The method, as described, allows analysts to consider alternative measures of average incremental cost based on the denominator of choice. For example, the method recognizes both the incremental cost of added capacity and the incremental cost of revenue-producing water.[30] The difference between the two is a reasonable estimate of the incremental cost of water loss on a per-unit basis. Water suppliers and regulators obviously have an interest in the amount of a system's unaccounted-for or nonaccount water and the incremental cost of these water losses. A reasonable estimate of this cost may induce some water supply managers to implement leak detection and repair programs as essentially a source of additional capacity.

Finally, the method allows for the calculation of more than one average incremental-cost estimate, based on the existence of more than one capacity alternative. These can be used to identify the least-cost alternative for planning purposes as well as ratemaking. If an estimate other than the least-cost amount is selected, the rationale for doing so should be made clear. More complicated analyses can incorporate sensitivity tests using different technology and system growth assumptions. At a minimum, water suppliers (and arguably their regulators)

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30 The importance of revenue-producing water as the denominator in calculating per-unit costs was emphasized in Patrick C. Mann and Janice A. Beecher, *Cost Impact of Safe Drinking Water Act Compliance for Commission-Regulated Water Utilities* (Columbus, OH: The National Regulatory Research Institute, 1989).

should be able to conduct a rudimentary analysis of future capacity needs within a planning framework.

The key benefits of the incremental least-cost method, then, are that it establishes a principle for choosing the next capacity increment and eliminates many of the concerns related to time frame, simplifies the calculation of annualized costs, provides for the assessment of the incremental costs of revenue-producing water, and sets forth an array of alternatives from which to choose. One of the chief benefits of the least-cost approach is that it encourages the analysis of nontraditional capacity increments, such as purchased water, leasing, water loss reduction, and conservation, within a planning framework.

Incremental least cost has analytical value as a reasonable proxy for marginal costs in a planning framework, even though it departs significantly from the textbook definition with regard to economic efficiency. It offers pragmatic solutions to some of the problems of marginal-cost estimation. Whether or not the value of ILC actually becomes the estimate used for rate design and planning decisions may involve a variety of other considerations.

The choice of any approach depends largely on policy goals and preferences about how to achieve them. Marginal-cost pricing has been advanced by economic theory to make more efficient the allocation of water supply resources. Although marginal-cost or incremental pricing is an imperfect approach to water utility ratemaking, substantial benefits may be gained from its use. At the very least, the results of such an analysis can be used for comparison with more traditional cost allocation and pricing methods in the context of least-cost planning.

Fully Allocated Costs and Marginal Costs Compared

In the regulatory context, an important difference between fully allocated methods and marginal or incremental cost methods is the sequence of procedures. With fully allocated cost methods, revenue requirement determination is followed by cost functionalization (using historic or embedded accounting costs), cost classification, interclass cost allocation, unit cost calculation, and, finally, rate design. One starts with the premise of the equality of revenues and costs followed by an interclass cost allocation that achieves the matching of costs and revenues. Obviously, there can be elements of arbitrariness in the transition from cost allocation to rate design. For example, an allocation method can be selected on the basis of producing allocations that justify a predetermined rate structure rather than on the basis of cost causation principles.

With marginal-cost methods, selection of the planning horizon is followed by the estimation of marginal unit costs (possibly on a functionalized basis), cost classification, rate design, and finally the reconciliation of costs and revenues. One starts with the premise of the equality of price and marginal cost followed by cost adjustments to insure compatibility with revenue requirements. Since unit costs are directly calculated as the bases for rate structure, incremental methods generally do not involve interclass cost allocations.

The differences between fully allocated and marginal-cost methods may be overstated. For example, average cost calculations often are used as approximations of incremental distribution cost and incremental customer cost since incremental cost calculations for these components tend to be less precise than for production (that is, treatment). Both fully allocated and marginal-cost estimations may be adjusted in the rate design process for competition differences across markets. Both methods can be employed to provide a sophisticated rationale for value of service pricing. Both methods do not automatically generate cost-revenue equality. That is, marginal-cost estimations can create rates needing adjustment prior to implementation; fully allocated costs can lead to rates needing adjustment after implementation.

Both fully allocated cost and marginal-cost methods involve value judgments. In fully allocated cost methods, judgments occur in cost assignments, capacity cost allocations, and in the allocation of administrative and general expense. Value judgments also occur in selecting a marginal-cost estimation method, in determining the planning horizon and the timing of new capacity, in defining incremental output, and in reconciling costs and revenues. It is quite possible that the same approximate rate structure can be obtained either by a fully allocated or a marginal-cost method.

Cost concepts have emerged that incorporate elements of both fully allocated cost and marginal-cost methods. For example, the concept of attributable cost is viewed as the direct cost of providing a service plus a portion of other costs which are influenced by the provision of the service, but which would not necessarily be avoidable if the service were not provided. In brief, attributable cost is a melding of embedded and incremental cost. In contrast, the concept of avoidable cost is virtually synonymous with marginal cost. The mixed test year is another concept that, in theory at least, combines the use of embedded and incremental costs. Many commissions prefer this approach to exclusive reliance on either historic or projected data.

Few attempts, however, have been made in the regulatory process to integrate fully allocated cost methods with incremental cost methods. William Melody must be considered a pioneer in assessing the potential for combining these approaches.[31] He suggested that fully allocated cost methods could be employed in allocating revenue requirements to customer classes and specific services. Thus, fully allocated costs would determine the overall revenue requirements attributable to individual customer classes, blocks of use, and other services. Incremental cost estimates could then be employed for designing rates for these classes and services (such as different usage blocks). Thus, incremental cost would assist (along with demand and market factors) in structuring rates. Therefore, fully allocated cost emerges as the revenue requirement standard while incremental cost remains an important factor in rate design.

The Wisconsin Public Service Commission is one of the few commissions that has attempted the actual integration of fully allocated cost and incremental cost methods.[32] The Commission in recent years has employed embedded cost studies to determine the range for cost allocation; embedded cost becomes the primary basis for determining revenue targets for individual classes of service. The Commission then employs incremental cost studies to indicate the point within the range for interclass allocations; incremental cost becomes the primary basis for rate design within classes of service. Further research on the integration of these approaches is probably overdue.[33] However, another issue requiring attention is the criticism

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[31] William H. Melody, "Interservice Subsidy: Regulatory Standards and Applied Economics," in Harry M. Trebing, ed., *Essays on Public Utility Regulation* (East Lansing, MI: Institute of Public Utilities, Michigan State University, 1971), 167-210.

[32] Robert J. Malko and Terrance B. Nicolai, "Using Accounting Cost and Marginal Cost in Electricity Rate Design," Eleventh Annual Rate Symposium on Pricing Electric, Gas, and Telecommunications Services (Columbia, MO: University of Missouri, 1985), 168-82.

[33] Patrick C. Mann, "Costing Method Selection: Rhetoric and Substance," in Patrick C. Mann and Harry M. Trebing, eds., *Public Utility Regulation in an Environment of Change* (East Lansing, MI: Institute of Public Utilities, Michigan State University, 1987), 519-28.

that combining fully allocated and marginal-cost approaches undermines the goals of both methods and produces meaningless results.

In sum, both fully allocated cost and marginal-cost estimations can provide regulators with important benchmarks for rate design. Since these methods can generate divergent results, an option available to regulators is to conduct multiple costing analyses thus producing several pricing benchmarks rather than singular cost values. For example, the results of fully allocated cost studies can be supplemented with incremental cost estimations thus providing both minimum and maximum standards for specific rates. Many of the rate design alternatives available today, and discussed in the following chapter, incorporate elements of fully allocated and marginal-cost analysis.

CHAPTER 5

RATE DESIGN FOR WATER UTILITIES

As already mentioned, the theoretical pricing ideal is to set rates equal to the cost of service; in other words, water prices should track water provision costs. However, a perfect match of water utility costs and water rates is not attainable. Noncost influences on rates include politics, past customs and practices, public (consumer) acceptance, adjacent community rates, and (in the case of publicly owned systems) the existing degree or extent of subsidization, taxation, and free service. An example of multiple objectives in designing water rates is the use of a rate structure combining increasing-block rates for residential service (to promote conservation) and decreasing-block rates for commercial and industrial service (to promote economic development). As water prices are increasingly affected by more stringent drinking water regulations, the policy objective of affordability may emerge, for example, in an increasing interest in lifeline rates.

There is a strong tradition in utility regulation that the fairness of rate differentials depends on differences in costs. However, to maintain this tradition these cost differentials must be defined or specified within reasonable limits. For example, cost differentials must be shown to exist to justify decreasing-block rates. If it cannot be established that there are marked differences in the cost of providing different volumes of water service, it would be appropriate to adopt a uniform rate even if this strategy does not track water supply costs with precision.

A recent survey commissioned by the U. S. Environmental Protection Agency provides a general overview of water rate structures according to utility ownership, as reported in table 5-1.[1] In the aggregate, many systems have rates that vary with the amount of water use. However, a significant proportion of systems use flat fees for water service. According to this source, few systems impose only a uniform rate (where the price per unit is constant as consumption increases) or a nonwater use measure (where charges are tied to something other than direct water use). The data are least specific about rate structures for ancillary systems,

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[1] Frederick W. Immerman, *Final Descriptive Summary: 1986 Survey of Community Water Systems* (Washington, DC: Office of Drinking Water, U.S. Environmental Protection Agency, 1987).

TABLE 5-1

WATER RATE STRUCTURES BY UTILITY OWNERSHIP

Type of Rate	Publicly Owned(a)	Privately Owned(b)	Ancillary(c)	All Systems
	Percent of Systems			
Variable rate(d)	58.5%	43.1%	16.7%	50.7%
Flat fee(e)	19.5	34.8	25.2	25.4
Uniform rate(f)	5.2	4.3	0.0	4.6
Nonwater use measure(g)	3.1	3.4	6.6	3.4
Other(h)	13.8	14.4	51.5	15.9
Total	100.0%	100.0%	100.0%	100.0%

Source: Frederick W. Immerman, *Final Descriptive Summary: 1986 Survey of Community Water Systems* (Washington, DC: Office of Drinking Water, U.S. Environmental Protection Agency, 1987), tables 5-6 and 5-7.

(a) Based on a sample of 434 utilities.
(b) Based on a sample of 209 utilities.
(c) Based on a sample of 18 utilities.
(d) A rate based on water use, varying with amount of water used.
(e) A fee paid monthly, quarterly, or annually, not based on water use.
(f) A constant rate per unit of water use.
(g) A charge based on something other than direct water use, such as service connection size, lot size, etc.
(h) A rate structure not described by any of the above. Many of these are combinations of fees and rates, or different types of rate structures for different customer classes.

where a combination of charges (reported as "other") may be the norm. Appendix E provides more detailed information on water rates for more than one-hundred United States cities, based on a 1990 survey by Ernst and Young.[2] This chapter explores rates design alternatives for water utilities.

Water Rate Structures

Most water bills consist of a combination of fixed charges (which do not vary with water consumption) and variable charges (which do vary with water consumption). One very basic ratemaking approach, designed specifically for small water systems, results in a fixed charge based on the utility's monthly fixed costs (debt service, reserves, and depreciation) coupled with a variable charge based on the utility's annual operation and maintenance costs, adjusted for inflation and anticipated changes in expenses (such as salary increases).[3]

Fixed charges can take the form of service charges, system development charges, capacity (demand) charges, and access fees. Water systems vary in whether they use fixed or variable charges to cover capacity costs. A fixed charge makes sense if a particular cost of service is associated with a specific customer (that is, if the customer withdraws from the water system the cost can be avoided). In brief, an access or fixed charge makes economic and financial sense if it reflects a connection used exclusively by the consumer, if the cost associated with the connection is independent of the consumer's volume of usage, and if the connection or access cost is essentially independent of production and delivery system design.

Choices about fixed and variable charges must be made in the context of tradeoffs among policy goals, including cost-of-service standards as well as consumer acceptance. For example, it is common in water service to employ a single rate structure for all retail consumers. The singular rate structure is simple to administer, easy to understand, and should recover the costs of service allocated

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[2] *Ernst & Young's 1990 National Water and Wastewater Rate Survey* (Charlotte, NC: National Environmental Consulting Group, Ernst & Young, 1990).

[3] John Regnier, "Case Study: Alabama Rate-Setting Study," presentation at the Annual Meeting of the American Water Works Association in Cincinnati, Ohio (June 1990).

to service classes via proper design of usage blocks. The rate design alternatives discussed herein mainly address the issue of defining usage blocks.

A variety of rate structures are used by water utilities. Illustrated in table 5-2 and summarized below are flat fees, fixture rates, uniform rates, decreasing-block pricing, increasing-block pricing, seasonal rates, excess-use charges, indoor/ outdoor rates, lifeline rates, sliding scale pricing, scarcity pricing, and spatial pricing. A subsequent section reviews other water charges.

Flat Fees

The simplest way to bill customers for water service is to use a flat rate or fee with all customers charged the same amount for service regardless of usage levels. No metering is required and fees may be collected according to any desired schedule, even annually. Flat fees can be considered cost-based to a degree because relatively high fixed costs characterize the water supply industry and may be appropriate if all members of the service class can be assumed to have uniform usage. They also insulate utilities from fluctuations in use caused by weather or other factors. However, most analysts reject the idea of flat fees because they send a poor price signal to customers about the cost of water service; nor do they provide an incentive to conserve. Flat fees, in fact, tend to encourage waste.

Fixed charges on the water bill, such as customer charges, also constitute a type of flat fee. These may be used in conjunction with a variable rate based on water consumption. Customer charges are appropriately collected as a flat fee because costs vary with the number of service connections. A variation on this idea is presented in table 5-3, which demonstrates the conversion of customer charges based on meter size. This type of approach presumes that customer costs vary in proportion to meter size and, thus, that customers with large-meter service (such as industrial users) should pay a higher charge than 5/8-inch-meter residential customers. Still, the customer charge is a per-meter charge that is fixed from month to month, as compared to a variable rate based on water usage.

A type of flat fee that does require water metering is the minimum bill, which is sometimes used to establish a basic usage block. This approach establishes a fixed fee linked to a minimal amount of water use; water consumption above this amount is charged at the established per-unit rate. An example of a minimum bill

TABLE 5-2
RATE DESIGN ALTERNATIVES

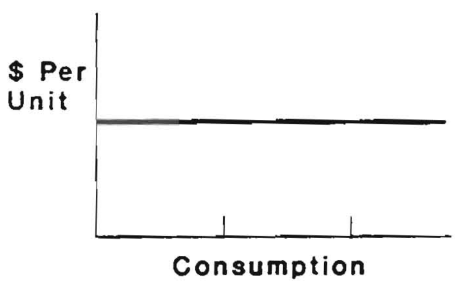
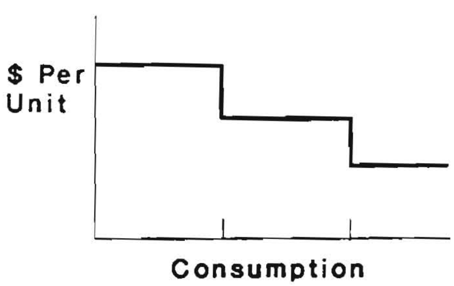
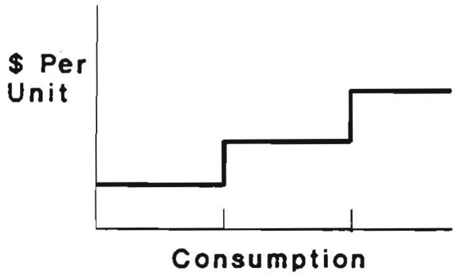
FLAT FEE* $/time period	Definition: A periodic fixed charge for water service that is unrelated to the amount of water consumed. Best used for: Only preferable when metering costs outweigh benefits. Considerations: Consumers are not sent price signals and may overconsume.
FIXTURE RATE* $/fixture	Definition: A periodic fixed charge for water service related to water-using fixtures on the customer's premises. Best used for: Only preferable when metering costs outweigh benefits. Considerations: May reflect the cost of service better than a flat fee.
UNIFORM RATE 	Definition: Price per unit is constant as consumption increases. Best used for: May be somewhat effective in reducing average use. Considerations: Large-volume users consider this structure equitable.
DECREASING BLOCK 	Definition: Price per unit decreases as consumption increases. Best used for: Retaining large-volume customers. Considerations: Large-volume users prefer this structure. When there is sufficient supply, the cost of supplying water will probably decrease as consumption increases.

TABLE 5-2 (Continued)

INCREASING BLOCK

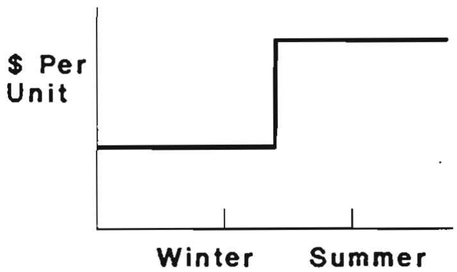


Definition: Price per block increases as consumption increases.

Best used for: Reducing average (and sometimes peak) use.

Considerations: Large-volume users consider this structure inequitable.

SEASONAL

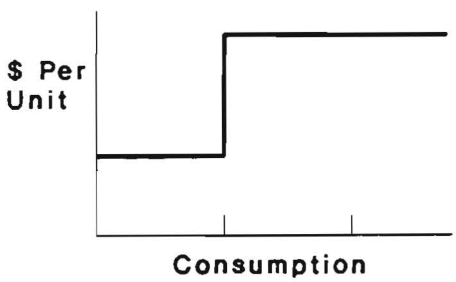


Definition: Price level during season of peak use (summer) is higher than the level during winter.

Best used for: Reducing peak use.

Considerations: Large-volume users consider this structure equitable. Effective for summer tourist community.

EXCESS USE



Definition: Price level is significantly higher for all water used above average, usually determined by winter use.

Best used for: Reducing peak use.

Considerations: Large-volume users consider this structure equitable.

INDOOR/OUTDOOR*

Definition: Price level for indoor use is lower than for outdoor use.

Best used for: Reducing peak use, defined by outdoor use, which is more elastic.

Considerations: Requires either two meters or detailed data and a somewhat sophisticated methodology.

TABLE 5-2 (Continued)

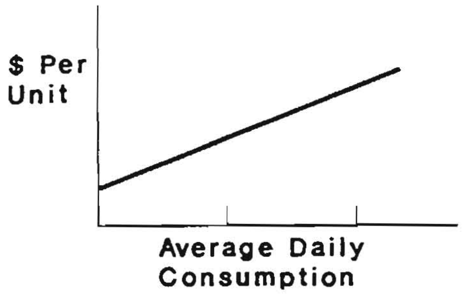
LIFELINE RATE

Definition: Price for "necessary" water use is kept low.

Best used for: Reducing average use.

Considerations: Usually used to ensure that low-income users are not unduly burdened by high prices.

SLIDING SCALE

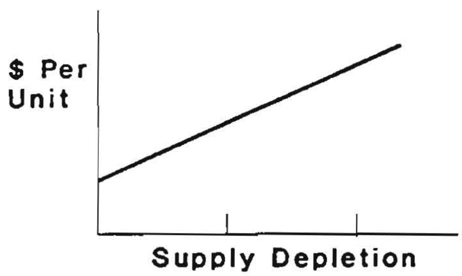


Definition: Price level per unit for all water used increases based on average daily consumption.

Best used for: Reducing average (and sometimes peak) use.

Considerations: Large-volume users consider this structure inequitable.

SCARCITY PRICING

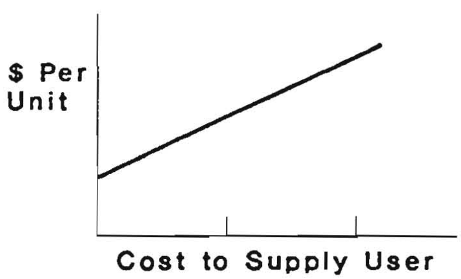


Definition: Cost of developing new supply is attached to existing use.

Best used for: Reducing average use.

Considerations: Used where supplies are diminishing (i.e., a finite supply) so that the costs of developing new supplies are paid for by current users.

SPATIAL PRICING



Definition: User pays for actual cost of supplying water to its establishment.

Best used for: Discouraging new or difficult to serve connections.

Considerations: Used in areas where the distribution system is being expanded rapidly and in difficult to serve areas.

Source: Adapted from American Water Works Association, Before the Well Runs Dry: Volume I--A Handbook for Designing a Local Conservation Plan (Denver, CO: American Water Works Association, 1984), 61-63. •Authors' construct.

TABLE 5-3

DEVELOPMENT OF CUSTOMER COSTS PER METER

Annual Customer Costs

Inside city	= $145,390/17,025 unit	= $8.54/unit
Outside city	= $19,250/1,810 units	= $10.64/unit

Meter size	Ratios	Annual Cost Per Meter
Inside City		
5/8-inch	1.00	$ 8.54
3/5-inch	1.25	10.68
1-inch	1.60	13.66
1-1/2-inch	2.60	22.20
2-inch	3.60	30.74
3-inch	7.00	59.78
5-inch	12.50	106.75
6-inch	25.50	217.77
Outside City		
5/8-inch	1.00	10.64
3/5-inch	1.25	13.30
1-inch	1.60	17.02
2-inch	3.60	38.30

Source: Paul J. Hartman, "Development and Design of Water Rate Schedules," in *AWWA Seminar on Developing Water Rates* (Denver, CO: American Water Works Association, 1973), IV-23.

based on the base-extra capacity method of cost allocation appears in table 5-4. In this example, minimum use is defined as 1,000 gallons a month. The fixed monthly charge covers not only customer costs but minimal base and extra capacity costs as well.

Fixture Rates

A rudimentary method for linking water rates to consumption, without metering actual use, is the fixture rate, illustrated in table 5-5. A fixture rate depends on accurate knowledge of water-using fixtures on the premises of each customer served--the number of faucets, toilets, bathtubs, showers, and so on. To the extent that water use varies with the presence of fixtures and the cost of service varies with water use, a fixture rate can be considered cost based. (It is certainly more so than a flat fee.) Fixture rates may be justified in instances when the cost of metering outweighs its benefits. However, fixture rates rely on highly imperfect and imprecise information and provide no incentive to conserve actual water use. For most systems, metering and variable rates are much preferred.

Uniform Rates

The simplest rate structure for metered customers is the uniform rate, under which all customers are charged the same amount for every unit of water consumed, regardless of consumption levels. Because the rate does not provide a volume discount and customers can minimize their total bill by avoiding excessive use, uniform rates provide an incentive to conserve. There is some evidence that metering alone can stimulate conservation, particularly with regard to outdoor water use.[4] Thus metering may lower peak demands.

Obviously, the uniform rate may not track costs with precision. In particular, uniform rates create a form of temporal cross-subsidization between peak and off-peak users. This rate averaging results in prices exceeding the costs of off-peak service and prices less than the costs of peak service; that is, off-peak users subsidize peak users. Uniform rates also create spatial cross-subsidization by

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[4] Brown and Caldwell, *Residential Water Conservation Projects, Summary Report* (Washington, DC: U.S. Department of Housing and Urban Development, 1984), chapter 7.

TABLE 5-4

MINIMUM BILL DESIGN BASED ON THE BASE-EXTRA CAPACITY COST ALLOCATION METHOD

	Monthly Cost: Inside-City/ 2-inch meter
Customer costs	
Meters and service-related costs ($1.6441/meter) x 2.9 equivalent meter and service ratio	$4.77
Billing and collection costs	2.29
Assume 1.0 thousand gallons monthly allowance, 150% maximum-day extra capacity factor, and 300% maximum-hour extra capacity factor	
Base costs	
$0.2984/thousand gallons x 1.0 thousand gallons	0.30
Extra capacity costs	
Maximum day at $19.0561/year/thousand gallons per day equals $0.0522/thousand gallons $0.0522/thousand gallons x 1.5 extra capacity factor x 1.0 thousand gallons	0.08
Maximum hour at $17.4545/year/thousand gallons per day equals $0.0478/thousand gallons $0.0478/thousand gallons x 3.0 extra capacity factor x 1.0 thousand gallons	0.14
Total minimum charge for 1.0 thousand gallon allowance	$ 7.58

Source: American Water Works Association, *Water Rates* (Denver, CO: American Water Works Association, Manual M1, 1983), 52.

TABLE 5-5

ILLUSTRATION OF A FIXTURE RATE

	Per Annum
Dwelling House, House occupied by one family	
supplied by one faucet	$20.85
Each additional faucet	3.50
One water closet of appropriate kind	6.30
Each additional water closet	3.80
One bath tub	4.85
Each additional bath tub	3.15
One self-closing urinal, none other allowed	4.15
Dishwasher	5.55
One set tub or automatic washer	5.55
Each additional set tub	1.75
Shower separate from tub at bath tub rate	
Outside shower	4.85
Turn on	8.00
Turn off	8.00

Source: Tisbury Water Works, "Rates and Regulations 1979/80," as reported in Charles F. Phillips, Jr., *The Regulation of Public Utilities* (Arlington, VA: Public Utilities Reports, Inc., 1984), 699. Tisbury Water Works is located in Vineyard Haven, Massachusetts.

ignoring geographic differentials in cost. However, the appeal of the uniform rate structure is linked to its simplicity and the deficiencies associated with multiple block rates. A variation of the uniform rate approach is standard tariff pricing in which the same rate structure is applied to a broad geographical area. In sum, the strengths of the uniform rate include relative simplicity, low administration costs, and ease of consumer understanding; compatibility with prevailing notions of fairness and equity; absence of volume discounts that discourage conservation; and conformity with the behavior of certain unit costs of water provision (for example, treatment) given increasing usage. Limitations of the uniform rate include an inability to track unit costs of water provision with precision (that is, some water provision costs, such as administrative and general costs, are fixed in nature and thus automatically decline with increasing water volume); and a lack of recognition that certain price-elastic users (for example, industrial) may resort to self-supply in the absence of a low tail-block rate, thus creating the serious regulatory problem of stranded capital investment.

Decreasing-Block Pricing

Decreasing (or declining) block rates, compared with uniform rates, provide a discount for large-volume use. An illustration based on the commodity-demand cost allocation method is provided in table 5-6. Proponents of decreasing-block rates contend that large users are entitled to lower per-unit prices because of the economies of scale in serving them. Ramsey pricing theory would argue that these customers should get a price break because their demand is more price-elastic, and reasonable substitutes for the method of water delivery may entice them to leave

TABLE 5-6

SIMPLE DECREASING-BLOCK-RATE SCHEDULE BASED ON THE COMMODITY-DEMAND COST ALLOCATION METHOD

		Rate Block	
	Total	First	Second
Actual water sales			
Thousand gallons	220,000	170,000	50,000
Percent	100.00	77.3	22.7
Weighted water sales (for demand allocation)			
Thousand gallons	390,000	340,000	50,000
Percent	100.00	87.2	12.8
Allocation of volumetric costs			
Commodity	$25,000	$19,300	$5,700
Demand	131,000	114,200	16,800
Total	$156,000	$133,500	$22,500
Rate per thousand gallons		$0.79	$0.45

Source: American Water Works Association, *Water Rates* (Denver, CO: American Water Works Association, Manual M1, 1983), 68.

the water utility system. Critics argue that decreasing-block rates encourage waste and in some cases subsidize large users. With decreasing-block rates, the incentive to conserve *declines* with greater consumption.[5]

The decreasing-block-rate schedule involves decreasing marginal or incremental rates with higher usage blocks. The decreasing-block-rate form recognizes that:

- Certain costs of water provision are fixed (such as depreciation of distribution mains) and thus automatically decline with increasing water usage.

- Certain users (such as industrial users) with relatively more price-elastic demands require lower rates to induce them to remain on the system. Lower rates can avoid forcing the remaining users to bear a larger portion of system costs.

- Certain large users have better load factors than residential and commercial users lowering the short-term unit capacity cost of supplying these users.

- Noncost objectives such as economic development, past practices, and adjacent community rates can be factors in ratemaking.

The original justification for the decreasing-block-rate structure was the pattern of decreasing unit costs with increasing usage (such as economies of scale with capacity expansion and improved capacity or load factors with existing capacity). The decreasing-block-rate structure passes these cost savings on to the consumer. Moreover, decreasing-block rates can be legitimized by carefully developing customer classes, so that the costs assigned to each class reflect load factors, fixed and variable cost proportions, and other appropriate variables. Arguably, the most important reason that decreasing-block rates have been retained is their revenue stability effect. Price-elastic demands tend to fall in the lower-priced tail blocks while price-inelastic demands tend to fall in the higher-priced initial blocks. The appeal of revenue stability is enhanced by the existence of excess capacity.

Another rationale for choosing decreasing-block schedules over uniform rates involves load factors. Larger users tend to have higher load factors (lower ratios

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[5] Duane Baumann, "Issues in Water Pricing," in Arizona Corporation Commission, *Water Pricing and Water Demand* (Phoenix, AZ: Arizona Corporation Commission, 1986), 9.

of peak demand to average demand) than smaller users, resulting in lower required extra capacities than with lower-load-factor smaller users. However, this rationale overlooks the critical issue of timing of demand (actual contribution to peak demand or peak responsibility), which causes the extra capacity to be built and the incremental capacity costs to be incurred.

Despite the reasoning in favor of decreasing-block-rate structures, significant limitations to this approach exist, including:

- The inability (particularly with the use of many blocks) to track costs with precision, given that some unit costs (such as pumping) tend to increase with increasing volume while other unit costs (treatment) tend to remain constant with increasing volume.
- The possibility that the volume discounts in the schedule exceed any discount defensible on cost-of-service principles; that is, there may be little cost justification for the magnitude of the intrablock rate differentials.
- Justification by costing methods that are questionable in their ability to determine cost causality.

A major criticism of decreasing-block rates is their possible failure to track costs with the result that smaller users subsidize larger users. In addition, block design exercises can be relatively crude with the number of blocks, usage breakpoint, and intrablock rate differentials not being cost justified. Although many argue that decreasing-block schedules for water service are justified by declining unit costs in both the short term and in the long term, substantial confusion continues regarding the circumstances under which decreasing-block rates are cost justified.

In the short term, larger volumes of usage on average tend to involve lower unit costs than smaller volumes, particularly since distribution costs tend to be fixed on a per-customer basis. However, declining unit costs do not necessarily justify declining marginal rates. Furthermore, while high fixed customer costs may provide the rationale for a flat service or customer charge, they do not necessarily provide the rationale for declining marginal commodity charges. In the long term, system expansion may involve some economies of scale. However, simply because incremental costs historically may have been below unit costs does not necessarily justify offering lower marginal rates to higher-volume users than to lower-volume users. That is, long-term incremental costs may be increasing and in the near-term or immediate future may be substantially above long-term unit costs. Also, the decreasing-block schedule tends to ignore the specific peak demands which cause the building of system peak capacity. Lower prices for higher volumes can exacerbate the peaking problem with regard to future capacity needs.

Decreasing-block rates cannot be justified in instances where economies of scale are exhausted. In other words, these rates may be appropriate only when a utility experiences decreasing unit costs with increased usage. Decreasing unit costs are attributable in the short term to improvements in capacity utilization and in the long term to economies of scale. There is reason to believe that many water systems have exhausted these scale economies. A contributing factor is the increase in system expansion costs caused by, among other things, the exhaustion of economies of scale in treatment, the depletion of more accessible sources of supply, and diseconomies in distribution. Therefore, increasing use in the short run may justify declining charges given load factor improvements. If this increased usage triggers an increase in required system capacity with the elevation of unit costs, then the promotion of use in the short run conflicts with increasing use in the long run.[6]

Finally, decreasing-block rates conflict with the policy goal of resource conservation. Because they promote consumption rather than conservation, decreasing-block rates may be particularly undesirable during periods of water scarcity. Low-volume customers may be especially resentful of high-volume price discounts. According to Phillips, "The ultimate effects of both a single rate structure for all users and a declining block rate structure not cost justified are price discrimination among customers and a failure to encourage water conservation."[7]

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6 Patrick C. Mann, "The Water Industry: Economic and Policy Issues," in Charles F. Phillips, Jr., ed., *Regulation, Competition and Deregulation--An Economic Grab Bag* (Lexington, VA: Washington and Lee University, 1979), 104.

7 Charles F. Phillips, *The Regulation of Public Utilities: Theory and Practice* (Arlington, VA: Public Utilities Reports, Inc., 1984), 703.

Increasing-Block Pricing

Under increasing (or inverted or inclining) block rates, the per-unit price increases with consumption. This rate structure is advocated as a method for reducing average and peak water usage. Large users bear the burden of costs associated with providing large quantities of water. With increasing-block rates, the incentive to conserve increases with greater consumption. Thus, increasing-block rates are a method of demand management. Although long-term effects are not certain, raising prices may be one method of inducing water conservation in the short term. What's more, while many alternative rate schedules may induce conservation, some, such as increasing-block rates, have been implemented for this very purpose in several major United States cities.[8]

The increasing-block-rate schedule involves increasing rates with increasing usage levels. This rate structure has been advocated as one form of conservation pricing. Its justification has been based on the existence of increasing incremental costs with capacity expansion and the goal of reducing income inequalities, both of which are debatable rationales. If increasing-block rates do not track costs, the result is that larger users subsidize smaller users. Increasing-block rates can cause decreasing average demand without corresponding decreases in peak demands; that is, the results include decreased load factors, needle peaking, and revenue erosion. Another problem is revenue instability associated with the potential loss of large customers who resort to self-supply.

The cost argument underlying increasing-block rates is that with incremental costs of new capacity increasing, price signals should discourage increasing usage. However, the cost causers are peak demand contributors who are not necessarily large users. One critic generally rejects the use of an increasing-block rate because it "unduly penalizes large customers who may have very favorable annual consumption characteristics."[9] There also may be other factors differentiating costs that are not accounted for by an increasing-block rate.

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[8] *Ernst & Young's 1990 National Water and Wastewater Rate Survey.*

[9] John D. Russell, "Seasonal and Time of Day Pricing," in American Water Works Association, *Water Rates: An Equitability Challenge* (Denver, CO: American Water Works Association, 1983), 96.

Several other potential problems exist with increasing-block rates. First, they are efficient only under unique circumstances. Second, prices that are below incremental costs in the initial blocks and prices that exceed costs in the tail blocks promote neither conservation nor efficient water use. Third, like decreasing-block rates, increasing-block rates pose problems associated with determining the number of blocks, consumption breakpoints, and rate differentials. Finally, a potentially serious problem is their potential impact on utility costs and revenues because of consumer conservation in response to higher water prices.

Nonetheless, a cost-justified increasing-block-rate schedule is feasible. According to the American Water Works Association (AWWA), "It is possible to use some elements of a cost-of-service study as a guide in the design of inverted rates."[10] Accordingly, a peak-use increasing-block-rate structure could be used to alleviate the poor load factor caused by summer residential use. The AWWA cautions, however, that increasing-block rates can be considered cost-of-service related only under special circumstances.

Seasonal Pricing

Time-differentiated, or seasonal, pricing takes notice of the cost differences between peak and off-peak usage and thus mitigates the temporal cross-subsidization between users. Excess-use rates and indoor/outdoor rates, discussed below, are variations of seasonal rates. Also, seasonal pricing may be combined with other rate structures; table 5-7 provides seasonal increasing-block rates adopted in Tucson, Arizona to encourage water conservation.

Most water utilities experience distinct seasonal peaks, due to weather-sensitive demands. The seasonal load pattern indicates that incremental costs may vary substantially over the water utility's annual demand cycle. Over time, given the peak-load problem, uniform pricing results in allocative inefficiency, an involuntary subsidy to peak users by off-peak users, and an inducement to increase system capacity to meet peak demands. Given the premise that water rates should track costs, seasonal rates provide consumers correct price signals that in turn may allow them to change usage patterns.

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10 American Water Works Association, *Water Rates*, 58.

TABLE 5-7

SEASONAL INCREASING-BLOCK WATER RATES FOR TUCSON, ARIZONA

Charges	Winter	Summer
April 1977		
Monthly service charge	$1.40	$1.40
Commodity charge		
First 1,000 cubic feet/month	0.55	0.55
Next 1,000 cubic feet/month	0.55	0.66
Next 3,000 cubic feet/month	0.55	0.77
> 5,000 cubic feet/month	0.55	0.88
May 1986		
Monthly service charge	$3.70	$3.70
Commodity charge*		
First 500 cubic feet/month	0.86	0.86
Next 500 cubic feet/month	0.97	0.97
Next 1,000 cubic feet/month	1.15	1.33
Next 1,000 cubic feet/month	1.31	1.64
Next 2,000 cubic feet/month	1.45	1.85
> 5,000 cubic feet/month	1.61	2.08

Source: Reported in Richard W. Cuthbert, "Effectiveness of Conservation-Oriented Water Rates in Tucson," *American Water Works Association Journal* 81 no. 33 (March 1989): 67 and 69.

Seasonal pricing, as well as daily peak load (or time-of-day) pricing are time-differentiation methods that follow marginal-cost pricing theory. Seasonal rates recognize that the unit operating cost of providing water varies between peak and off-peak days, that capacity requirements essentially are determined by peak demands, and that peak users essentially are responsible for the capacity required to serve the peak demand, while off-peak users bear little responsibility. Therefore, seasonal rate design involves assigning lower costs to usage on off-peak days. Seasonal rates impose higher prices during periods of peak use (in the warm-weather months) to recover costs associated with the higher capacity needs caused by lawn sprinkling and landscaping. Daily peak-load rates are infrequently used by water utilities because, unlike electricity, the ability to store water mitigates the daily peaking problem, the cost of water does not vary significantly on an hourly basis, and the investment required for metering under these rates could outweigh the benefits.[11] Time-of-day pricing may, however, be an appropriate load management tool for regulating water pressures. Better load management may help some water utilities avoid building (and paying for) water supply capacity, a tendency exacerbated by occasional drought conditions when peak demand levels are elevated. Also, maximum-hour peaks are appropriately considered in designing fire protection rates (discussed below).

The prerequisites to effective seasonal pricing are several.[12] First, there must be substantial variation in demand between peak and off-peak periods. Second, installed capacity requirements must be determined primarily by the peak demand confronting the water system. Third, the water utility must have peak demands that occur consistently during the same season. Finally, the utility must be able to estimate the cost differences between meeting peak and off-peak demands. Russell provides some guidelines for utilities contemplating the use of seasonal rates:[13]

- Detailed planning, complete and adequate information programs for customers, and careful administrative and computer procedures are essential for a successful program.

- Any seasonal rate introduced should be relatively modest in price as compared with winter rates at the outset, with later adjustments to increase the differential.

- The summer excess-charge method appears to be the superior method for matching revenues with costs and for discouraging maximum summer demands.

- Any type of summer seasonal rate can cause more variations in revenue than a uniform annual rate.

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[11] John D. Russell, "Seasonal and Time of Day Pricing," in American Water Works Association, *Water Rates: An Equitability Challenge*, 91.

[12] Mann and Schlenger, "Marginal Cost and Seasonal Pricing," 7.

[13] Russell, "Seasonal and Time of Day Pricing," 96.

- A seasonal rate may not be appropriate for all water systems. Where annual supplies are more than adequate and system capacity is adequate or possibly excessive, a seasonal rate may discourage water sales and thus increase the cost of water for the remaining sales, without any substantial benefit to the water system except possibly to better recover costs from summer peaking customers.

The potential benefits of seasonal rates include increased production efficiency (through annual load factor improvements) and reduced peak demands, both of which should enhance the water utility's financial condition. Seasonal rates can be an effective tool for reflecting intertemporal cost differentials without elaborate metering (as required by time-of-day pricing). Reducing peak demands may help extend available water supplies and postpone or eliminate the need for capacity additions.[14] Also, seasonal rates promote conservation while avoiding a problem associated with purely voluntary conservation--that is, declining average usage (but not peak usage) resulting in deteriorating load factors and revenue shortfalls. Finally, for water consumers who are willing and able to modify usage patterns, seasonal rates can result in decreased water bills. In sum, the reasons for considering seasonal pricing--namely conservation and marginal-cost theory--may be compelling for some water systems and their regulators.

Excess-Use Charges

Some analysts prefer the excess-charge form of seasonal pricing (even though the summer/winter form may be easier to administer and easier for customers to understand) because it is more effective for purposes of cost recovery and conservation.[15] The excess-use charge essentially is an increasing-block schedule with two blocks. It requires the determination of "base" and "excess" consumption, with corresponding prices. Excess charges are applied to usage in excess of average winter or base usage. Although some consumers may view this method as arbitrary, the imposition of excess use charges or penalty fees is not uncommon during periods of water shortage, and evidence suggests that the public is supportive of their

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[14] Ibid., 92.

[15] Ibid.

use.[16] However, as a general tool of rate design, this approach is hampered by the difficulty in defining excess use and perceptions that the chosen definition is arbitrary, capricious, or inequitable.

Indoor/Outdoor Rates

A variation on the seasonal rate structure not mentioned in the AWWA discussion of rate schedules is the indoor/outdoor rate schedule.[17] This approach is specifically tailored to household consumption levels, as compared to excess-use charges which are based on averages. This approach is designed to address the problem of inequity occurring when large households with water-efficient landscaping pay more for water than small households with inefficient landscaping, even though the latter contributes "more than its fair share" to the summer peak. Rates for indoor and outdoor use can be charged by installing two meters in each household. This not only is costly, it also could be bypassed by the mischievous homeowner who runs a garden hose from the kitchen sink.

A methodological solution exists to this problem: household consumption during the off-peak season can be used to estimate basic indoor usage during the year. Amounts in excess of this can be billed at the outdoor water rate. Most water suppliers have the data necessary to make this calculation and may use it at present to estimate bills. While the method is slightly inferior to a dual metering system, it may be more equitable among households than simple seasonal rates or excess-use charges.

One potential issue is that treatment costs associated with safe drinking water standards should generally be assigned to indoor water use, or more specifically, to human consumption. However, there are significant economies of scale for water treatment and without a redundant distribution system the differentiation of costs on an indoor/outdoor basis is largely irrelevant. An even more difficult issue is that lower indoor rates provide a disincentive for indoor water conservation. In fact, customers with high outdoor use levels may have an

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16 Edward F. Renshaw, "Conserving Water Through Pricing," *American Water Works Association Journal* 74 no. 1 (January 1982): 5.

17 Gary C. Woodard, "A Summary of Research on Municipal Water Demand and Conservation Methodologies," in Arizona Corporation Commission, *Water Pricing and Water Demand* (Phoenix, AZ: Arizona Corporation Commission, 1986), 43-47.

incentive to use indoor water to excess during the winter inflating their base level. The result could be an increase in average use and only slight reductions in peak (summer) use.

Lifeline Pricing

Lifeline pricing can be viewed as another variation of the increasing-block theme. It provides a lower per-unit price for a specified level of consumption so that low-income consumers can receive water service for basic needs at a reasonable cost. In most formulations, the lowest block is priced below the cost of service. Thus the rate is policy-based, not cost-based.

Other than social and humanitarian benefits, some of the key rationales for lifeline rates are that they make it possible to retain customers on the utility system; that they reduce the frequency and cost of disconnections, collections, and bad debt because of nonpayment; and that by providing an affordable bill, many customers can meet the payments rather than continue to be served without paying anything. One of the key drawbacks is that lifeline rates send inappropriate pricing signals, and thus may not encourage conservation.

Lifeline rates in energy are normally provided only to qualifying individuals according to specified poverty indicators. Such rates have been infrequently considered by water utilities or their regulators, probably in large part due to the relative affordability of water. Also, opponents of lifeline programs generally focus on the problem of cross-subsidization and the belief that lifeline policies essentially provide social welfare benefits that are more appropriately administered by governments and funded by general tax revenues.[18] Many also prefer volunteer contributions by some customers that establish special funds for needy customers, with the utility assisting in the process.[19] One fact that mitigates the need for lifeline rates in water supply is that low-income citizens often live in public housing or apartment buildings that are master-metered. Thus, individuals are not

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[18] John F. Guastella, "Lifeline and Social Policy Pricing," in American Water Works Association, *Water Rates: An Equitability Challenge*, AWWA Seminar Proceedings (Denver, CO: American Water Works Association, 1983), 82-87.

[19] "Project Water Help Meets with Success," *Water* (Winter 1987), 25.

directly responsible for the water bill. However, higher water prices are paid indirectly through higher rents.

As the cost of drinking water escalates because of more stringent water quality regulations and as the issue of affordability continues to be debated, lifeline rates may receive more attention. The affordability issue is intrinsically related to the issue of water quality and willingness and ability to pay for it. It also is appropriate to consider conservation programs in conjunction with lifeline rates to minimize waste and heighten consumer awareness of water's increasing value.

Sliding-Scale Pricing

Sliding-scale pricing (like increasing-block rates) assigns higher prices to higher consumption levels, but ties prices to average daily consumption rather than total consumption. Therefore, the strengths and limitations of sliding scale rates are similar to those of increasing-block rates. That is, sliding scale pricing may encourage water conservation, but may also cause larger users to bypass the water system in favor of self supply.

Scarcity Pricing

Another variation of increasing-block rates, similar to sliding scale rates, is scarcity pricing. Water supplies are increasingly threatened both by natural and artificial causes.[20] Scarcity pricing stems from marginal-cost theory and assigns higher prices in accordance with the depletion of existing supplies. It may be appropriate for pricing finite water supplies where it is desirable to have current users pay for developing new supplies.

Spatial Pricing

Another pricing innovation is zonal or spatially differentiated rates. Spatial rates complement time-differentiated rates and may be appropriate for utilities with core and satellite areas than for interconnected systems. Requiring satellite systems

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20 Janice A. Beecher and Ann P. Laubach *Compendium on Water Supply, Drought, and Conservation* (Columbus, OH: The National Regulatory Research Institute, 1989).

to pay full development costs may discourage water system expansion, a result which may or may not be consistent with local development and land-use planning considerations. Contributions-in-aid-of-construction for new developments are a form of spatial pricing. In addition, hook-up fees can be assessed to cover the cost of initiating service for new customers. If these fees are high, some prospective customers may be discouraged from connecting to the system. Spatial pricing and hook-up fees are designed to recover the ongoing costs of water service.

Uniform rates over geographic space involve cross-subsidization. The rate averaging results in prices exceeding costs for some users and failing to meet costs for others. It is possible that at current rate levels, design and administrative costs may exceed the efficiency gains from spatial pricing. An example of imperfect spatial rates is the urban/suburban variances associated with publicly owned systems. Some of these differentials are justified by capacity and pumping costs while others are motivated by annexation policies and the objective of taxing nonvoters.

Some rate design proposals would have new customers paying higher rates than existing customers. Little economic justification exists, however, for such a distinction between old and new customers. Both groups are jointly responsible for water system expansion and the development of higher-cost supplies; that is, each group contributes to the total system cost associated with meeting average demand. A rational basis for differential treatment between old and new customers is unequal contributions to peak demands. If new customers impose specific costs upon the system that would not be avoided if existing consumers decreased their usage (such as the cost of extending distribution lines), price variances between old and new customers are justified via service connection charges. Again, it may be necessary to take local development and land-use planning considerations into account.

Other Water Charges

Discussed briefly here (and in detail by the American Water Works Association) are four other types of water service charges: dedicated-capacity charges, capital contributions, fire protection charges, and ancillary charges.[21]

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[21] See American Water Works Association, *Water Rates and Related Charges* (Denver, CO: American Water Works Association, Manual M26, 1986).

Table 5-8 provides a summary of the specific types of charges that fall within these general categories.

Dedicated-Capacity Charges

Dedicated-capacity charges are designed to recover capacity costs from those potential future customers for whom the capacity is being installed. The two principal approaches are availability charges and demand-contract charges, compared in table 5-9. Both methods are cost-based and result in the calculation of fixed charges. Availability charges allow the utility to pay for construction. When facilities are complete, they usually are replaced by regular water rates charged to a group of customers. A demand contract is typically entered into by a large water user and contains specific terms of service. Care must be taken that the demand-contract rate not be unduly price discriminatory.

Capital Contributions

Capital contributions by utility customers are used to support water system improvements such as:[22]

- expanding the quantity of water supply available for normal weather periods, droughts, and emergencies for existing customers;
- providing source-of-supply protection from potential or actual contaminants, and treatment facilities necessary to assure water quality compliance with new or upgraded standards;
- providing additional distribution, storage, or pumping capacity to meet system expansion needs for both fire service and general water service;
- upgrading and replacing older facilities to improve reliability, reduce maintenance and repair costs, increase capacity, and meet current standards; and
- expanding the system to provide service to new customers and developing areas.

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22 Ibid.

TABLE 5-8

SELECTED SPECIAL WATER CHARGES

Dedicated-capacity charges
- Availability charges
- Demand-contract charges

Capital contributions
- Main extension charges
- Participation charges
- System development charges (system buy-in or incremental cost)
- Government grants and low-interest loans

Fire protection charges
- Private fire-protection charges
- Public fire-protection charges

Ancillary charges
- Field-service charges
  - Turn-on/turn-off service
  - Field collections
  - Illegal turn-ons and open meter bypass
  - Special meter readings and final meter readings
  - Meter testing, repairs, resetting, or size change
  - Installation of special or remote meter reading devices
  - Meter boot or stop box clean-out, dig-up, or replacement
  - Special appointments
- Office-service charges
  - New account or transfer charge
  - Collection related charges
  - Administrative, paperwork, and copying fees
  - Wastewater billing fees
- Jobbing and merchandise sales
- Tapping charges
- Application, engineering, and inspection fees
  - Main inspection, filing, and contracts
  - Service-connection and cross-connection inspection
  - Engineering design and water service location
- Construction-water charges
- Miscellaneous work charges
- Unauthorized water use charges
- Unit-cost development charges
- Penalties for water conservation violations
- Special permits (such as irrigation and hydrants)

Source: Derived from American Water Works Association, *Water Rates and Related Charges* (Denver, CO: American Water Works Association, 1986); and Robert M. Wilson, "Special Charges Used by the Denver Water Department," in *AWWA Seminar on the Ratemaking Process: Going Beyond the Cost of Service* (Denver, CO: American Water Works Association, 1986), 11-18.

TABLE 5-9

DEDICATED-CAPACITY CHARGES: A COMPARISON OF METHODS

Availability Charge	
Total investment in plant to be included in availability charge	$450,000
Annual costs	
Debt service	45,000
Payment in lieu of taxes	30,000
Projected annual cost for inspection, billing, and certain (fixed) operation and maintenance expenses	45,000
	$120,000
Monthly charge based on 2,000 equivalent potential customers	$5.00
Demand-Contract Charge	
KYZ Corporation Requirements	
Average daily demand	1.0 mgd
Maximum daily demand	1.5 mgd
Maximum hourly demand	2.0 mgd
Construction of 5,000 feet of 12" water main from treatment plant to site. Estimated cost is $250,000.	
ABC Water Utility	
Annual fixed cost of 2.0 mgd surface supply	$100,000
Annual fixed cost of 4.0 mgd treatment facility	150,000
Annual variable costs (primarily power and chemicals) per million gallons	200.00
Demand charge	
Dedicated construction: $250,000 at 25% (estimated)	62,500
Source of supply ($100,000/2.0 mgd) x 1.0 mgd	50,000
Treatment facility ($150,000/4.0 mgd) x 1.5 mgd	56,250
Total demand charge per year	$168,750
Commodity charge per million gallons	$200.00

Source: Adapted from Vito F. Pennacchio, "Demand and Availability Charges," in AWWA Seminar on The Ratemaking Process: Going Beyond the Cost of Service (Denver, CO: American Water Works Association, 1986), 9-10.

Four types of capital contributions are main extension charges, participation charges, system development charges, and government grants and low-interest loans. The system buy-in and incremental-cost methods for calculating system development charges are compared in table 5-10. System development charges also constitute contributions-in-aid-of-construction, which are increasingly controversial because of taxing and ratemaking implications. The growing capital needs of the water-supply industry brought about by drinking water standards, population growth, and a deteriorating infrastructure may require more attention to the use of capital contributions for system improvements.

Fire Protection Charges

Designing fire protection rates may be the most perplexing task of rate design for water utilities. Fire protection is central to the design of water distribution facilities; yet with good fortune these services can go unused for long periods of time. The cost of private fire protection clearly is assignable while the cost of public fire protection requires some method of allocation. In table 5-11, the equivalent-connection, hydrant/inch-foot, and relative fire-flow requirements methods are compared.

Fixed costs, such as the cost of fire hydrants, are easily translated into fixed charges using some kind of averaging. Capacity costs pose another problem. Cost-based rates, using marginal-cost pricing theory, actually may call for three-tiered pricing, with base costs, seasonal peak costs, and daily (fire protection) peak costs. The costs associated with these peaks can be treated as total service incremental costs.[23] This approach probably results in relatively low fire protection rates. In contrast, a standard of reasonableness for establishing maximum fire protection charges is stand-alone cost or the hypothetical cost associated with a water utility designed to provide fire protection services only, and not general water service. In between lies a price based on the joint provision of general water service and fire

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[23] On the incremental treatment of fire protection costs, see J. Richard Tompkins, "Fire Protection Charges," in *AWWA Seminar on the Ratemaking Process: Going Beyond the Cost of Service* (Denver, CO: American Water Works Association, 1986).

TABLE 5-10

SYSTEM DEVELOPMENT CHARGES:
A COMPARISON OF METHODS

System Buy-in Method	Original Cost ($000)	Accumulated Depreciation ($000)	Net Cost ($000)
Source of supply	5,000	1,000	4,000
Treatment and pumping	8,000	1,200	6,800
Distribution system	12,800	1,800	11,000
Services, meters, and hydrants	4,800	800	4,000
General structures	1,400	200	1,200
	$32,000	$5,000	$27,000
Less net cost of			
Distribution system			11,000
Services, meters, and hydrants			4,000
			12,000
Net investment in backup plant less:			
Outstanding bonds			8,000
Total equity investment			$4,000
Number of customers			20,000
Average net equity investment per equivalent 5/8-inch-meter customer			$200
System development charge			$200

Incremental-Cost Pricing Method	
Annual revenue under existing rates for typical 5/8-inch customer	$205
Less: Annual operation and maintenance expenses ($115) and annual replacement and improvement costs ($30) to be met from rates	145
Net revenue available to service new debt	$60
Debt that can be serviced (assume 20-year debt amortization at 10% annual interest rate ($60/0.1175)	$510
Estimated total investment in backup facilities required to serve a new 5/8-inch customer	$1,300
System development charge	$790

Source: American Water Works Association, *Water Rates and Related Charges* (Denver, CO: American Water Works Association, 1986), 15 and 16.

TABLE 5-11

FIRE PROTECTION RATES: A COMPARISON OF METHODS

Equivalent-Connection Method

	Total	Public	Private
Prorated demand costs	$110,900	$85,400	$25,500
Direct: hydrants	57,000	57,000	--
Direct: private firelines	9,200	--	9,200
	$177,100	$142,400	$34,700

	Number	Size Factor	Eq. 6-inch Connection	Charge/ Connection	Revenues
Public fire services					
Town A hydrants	388	1.0	388		
Town B hydrants	255	1.0	255		
Town C hydrants	512	1.0	512		
	1,155		1,155(77%)	$123.30	$142,412
Private fire services					
5-inch service lines	100	0.44	44	44.00	$ 4,400
6-inch service lines	200	1.00	200	100.00	20,000
8-inch service lines	60	1.72	103	172.00	10,320
	360		347(23%)		34,700
Total equivalent 6-inch connections			1,502		177,132

Hydrant/Inch-Foot Method (Public Fire Protection)

	Inch-feet	Rate	Amount	Hydrants	Rate	Amount	Total
Town A	3,892,000	$0.0050	$19,910	388	$49.35	$19,148	$ 39,058
Town B	2,613,000	0.0050	13,065	255	49.35	12,585	25,650
Town C	10,485,000	0.0050	52,425	512	49.35	25,267	77,692
Total	17,080,000		$85,400	1,155		$57,000	$142,400

Relative Fire-Flow Requirements Method (Public Fire Protection)

	Service Class	Customers	Fire Flow	Equiv. Cust.	Rate	Revenues
Town A	Residential	5,700	1.0	5,700	$7.62	$ 43,434
Town B	Residential	3,700	1.0	3,700	7.62	28,194
Town C	Residential	6,620	1.0	6,620	7.62	50,444
	Commercial	1,080	2.25	2,430	17.14	18,511
	Industrial	60	4.0	240	30.48	1,829
		17,160		18,690		$142,412

Source: Adapted from American Water Works Association, *Water Rates and Related Charges* (Denver, CO: American Water Works Association, Manual M26, 1986), 9-10.

protection by a single utility, perhaps using the average incremental pricing approach.

More complex pricing schemes for fire protection take into account such factors as property values and insurance rates. While some view fire protection as a discrete service, others believe that it is essentially a public good that should be paid for through tax dollars. Obviously, many policy considerations enter into discussions of these rates. In some jurisdictions, public safety considerations may outweigh those of cost causality.

Ancillary Charges

Ancillary charges or fees are designed to recover, as closely as possible, the actual cost of providing specific services, such as tapping and inspections. A selection of these services appears in table 5-8. Water utilities should take care both to recognize the incidental costs associated with certain services they provide and to develop appropriate fee schedules that reflect them.

Rate Structures Approved by Regulatory Commissions

As reported in table 5-12, the types of water rates imposed by regulated water utilities in the reporting jurisdictions for either residential or commercial and industrial use fall predominantly into three categories: unmetered, uniform, and decreasing-block-rate structures. The results indicate that uniform rates are used in many states for both residential or commercial and industrial water service. Over half of the commissions surveyed indicated that all three types of rates were being used for residential customers, and that uniform and decreasing-block rates are under use for commercial and industrial customers. In all, unmetered charges were mentioned slightly more often than decreasing-block rates for residential water use, while the opposite was true for commercial and industrial rates. Moreover, a sizeable share of the commissions reported the use of increasing-block rates and seasonal rates for all service classes. The responses revealed further that increasing-block rates and seasonal rates were more frequently approved for residential customers than for commercial and industrial customers.

TABLE 5-12

WATER STRUCTURES APPROVED BY STATE REGULATORY COMMISSIONS

State Commission	Residential Rates							Commercial/Industrial Rates						
	FF	FX	UN	DB	IB	SE	O	FF	FX	UN	DB	IB	SE	O
Alabama	X	-	-	X	-	-	-	X	-	-	-	-	-	-
Alaska	X	-	-	-	-	-	-	X	-	-	-	-	-	-
Arizona	-	-	-	X	X	X	-	-	-	-	X	X	X	-
Arkansas	-	-	X	-	-	-	-	-	-	X	-	-	-	-
California	X	-	X	X	X	X	-	X	-	X	X	X	X	-
Colorado	-	-	X	-	-	-	-	-	-	X	-	-	-	-
Connecticut	X	X	X	X	-	X	-	X	-	X	X	-	X	-
Delaware	X	-	X	X	-	-	-	X	-	X	X	-	-	-
Florida	X	-	X	-	-	-	-	X	-	X	-	-	-	-
Hawaii	-	-	X	-	-	-	-	-	-	X	-	-	-	-
Idaho	X	-	X	-	-	(a)	-	X	-	X	-	-	(a)	-
Illinois	-	-	X	X	-	-	-	-	-	-	X	-	-	-
Indiana	X	-	-	X	-	-	-	X	-	-	X	-	-	-
Iowa	-	-	X	-	-	-	-	-	-	X	-	-	-	-
Kansas	-	-	X	-	-	-	-	X	-	-	-	-	-	-
Kentucky	X	-	X	X	-	X	-	X	-	X	X	-	X	-
Louisiana	X	-	X	X	-	-	-	-	-	X	X	-	-	-
Maine	-	X	X	X	-	-	-	-	X	X	X	-	-	-
Maryland	X	-	X	X	X	X	-	X	-	X	X	X	X	-
Massachusetts	X	X	X	X	X	X	-	X	X	X	X	X	X	-
Michigan	X	-	X	X	X	-	-	-	-	X	X	-	-	-
Mississippi	X	-	-	X	-	-	-	X	-	-	X	-	-	-
Missouri	-	-	X	-	-	X	-	-	-	X	-	-	-	-
Montana	X	X	X	-	X	-	-	-	-	X	-	-	-	-
Nevada	X	-	X	X	X	X	-	X	-	X	X	X	X	-
New Hampshire	-	-	X	-	-	-	-	-	-	X	-	-	-	-
New Jersey	X	-	X	X	X	X	-	X	-	X	X	X	X	-
New Mexico	-	-	-	X	-	-	-	-	-	X	-	-	-	-
New York	X	-	-	X	X	X	-	-	-	X	X	-	X	-
North Carolina	-	-	X	-	-	-	-	-	-	X	X	-	-	-
Ohio	X	-	X	X	-	X	-	X	-	X	X	-	X	-
Oklahoma	X	-	X	X	X	-	-	X	-	X	X	X	-	-
Oregon(b)	X	-	X	X	-	-	-	-	-	-	-	-	-	-
Pennsylvania	X	X	X	X	-	-	-	-	-	-	X	-	-	-
Rhode Island	X	-	X	-	-	X	-	X	-	X	-	-	X	-

TABLE 5-12 (continued)

State Commission	Residential Rates FF	FX	UN	DB	IB	SE	O	Commercial/Industrial Rates FF	FX	UN	DB	IB	SE	O
South Carolina	X	-	X	X	X	-	-	-	-	-	X	-	-	-
Tennessee	-	-	X	X	-	-	-	-	-	X	X	-	-	-
Texas	X	-	X	-	X	-	(c)	X	-	X	-	X	-	-
Utah	X	-	X	X	X	-	-	-	-	X	-	-	-	-
Vermont	X	-	X	-	X	-	-	X	-	X	-	X	-	-
Virginia	X	-	X	-	-	-	-	-	-	X	-	-	-	-
Washington	X	-	X	X	X	X	-	X	-	X	X	X	X	-
West Virginia	-	-	X	X	-	-	-	-	-	X	X	-	-	-
Wisconsin	X	-	-	X	-	-	-	X	-	-	X	-	-	(d)
Wyoming	X	X	X	X	-	-	-	-	X	-	-	-	-	-
Virgin Islands	-	-	X	-	-	-	-	-	-	X	-	-	-	-
Number of commissions	31	6	38	29	15	14	1	22	3	34	25	10	13	1

Source: 1990 NRRI Survey on Commission Regulation of Water Systems.

FF = Flat fee
FX = Fixture rate
UN = Uniform rate
DB = Decreasing-block rate
IB = Increasing-block rate
SE = Seasonal rate
O = Other

(a) One system adds a summer surcharge to the uniform rate.
(b) No commercial or industrial customers.
(c) Improvement surcharge.
(d) Decreasing-block with lower blocks increasing.

Conclusion

Whatever rate design is selected, it can be appropriately evaluated by how well it meets the utility's revenue requirement. A variety of methods exist to do this, ranging from sophisticated computer simulation modeling to a basic bill tabulation analysis.[24] In the end, it is not uncommon to make adjustments to the rate structure either to match revenue requirements or meet other policy goals.

Despite the many methodological alternatives, rate design tends to be as much art as science, leaving a considerable degree of discretion to regulators. For publicly owned water utilities, it may be simpler to incorporate policy goals other than cost causation into the ratemaking process. For investor-owned water utilities under the jurisdiction of the state public utility commissions, these goals must be reconciled with traditional principles of regulation. The inclination of the commissions to promote wise use or other policies may depend on legislative mandates, precedents in other utility areas, and whether outcomes are considered consistent with the public interest and other regulatory objectives.

In his critique of lifeline rates, one analyst concludes with the general observation that rate design involves a considerable degree of "informed judgment" and that:

> Specific rate structures have and will continue to incorporate features relating to particular characteristics and objectives. So long as basic cost principles are not significantly compromised, there can be room for "policy" adjustments to effect gradual trends toward such goals as conservation, fuller recognition of economies of scale and even minimizing impact on low-use customers.[25]

The harsh reality is that not every policy goal can be met within the confines of a single--or simple--rate structure.

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[24] American Water Works Association, *Water Rates* (American Water Works Association, Manual M1, 1983), Appendix.

[25] Guastella, "Lifeline and Social Policy Pricing," in American Water Association, *Water Rates: An Equitability Challenge*, 87.

CHAPTER 6

CONCLUSIONS

This report has focused mainly on the costing and pricing of water service. This focus is not intended to imply or indicate that other issues are less important. Economic arguments tend to elevate pricing above other concerns; indeed, more efficient pricing is expected to solve a myriad of production, consumption, and allocation problems. But it is important to recognize that better pricing of water, though essential, is not a panacea for all the issues facing the providers of public water service.

Some Other Issues

Among the important policy issues distinct from price is the concern for water quality both at intake treatment and sewage discharge points. A related issue is the optimal mix of treatment expenditures and water quality. Given surface sources, there is the regulatory policy issue of trading off increased sewage treatment costs upstream for decreased water treatment costs downstream. The focus on water service costing, pricing, and investment decisions for commission-regulated water utilities should not detract from the importance of making similar decisions concurrently for sewage disposal. Water and sewage systems are interrelated (for example, a decrease in household water consumption can result in a decrease in the volume of waste). Separating the decisionmaking for water and sewage pricing can negate efficient pricing and investment policies in water provision. One can argue that sewage cost recovery and pricing is at present less efficient than water service costing and pricing.

Furthermore, the efficient costing and pricing of centrally supplied water service should not be viewed as a complete solution to the efficient use and allocation of water supplies. For example, the historically inefficient pricing of irrigation water in the western United States probably more than offsets any societal gains to be derived from the increased efficiencies in pricing public water supplies. In some states, even in terms of public water service, the proportion of water supplied by commission-regulated water utilities is relatively small. The water utilities regulated by the California Public Utilities Commission, for example, provide an estimated 2 percent of the total public water supply in California. Thus, any attempts by the Commission to attain efficient water pricing and water conservation will have but a small effect on the overall use of public water supplies in that state. Pricing inconsistency among the major water use sectors and between regulated and unregulated sectors will continue to pose a problem.

One of the most difficult unresolved issues is the need to define priority uses for water, which also should be reflected in price. Unfortunately, price and priority in water use are not always consistent. During periods of drought, the burden of use restrictions can be greater for residential users than for irrigation users. Appropriate price signals can redefine priorities and encourage adoption of permanent water conservation measures in some sectors. However, priorities may also be determined by other public policies, specifically those reflected in drought contingency and long-term supply plans. Where water conservation is concerned, commissions should consider water pricing as an important tool but recognize that consumer education about the wise use of water is equally important.[1]

Long-term planning is an emerging issue in water supply. Concerns about water quality and quantity are contributing factors, and there is an increasing need to integrate the many governmental institutions involved in water. Federal, state, and local governments all make policies affecting water, yet often there is limited coordination of their efforts. State public utility commissions need to work more closely with state drinking water and environmental officials responsible for water policy, particularly as to the role of prices in water supply and demand.

There also is a growing concern about whether the structure of the water industry is suited to meet contemporary demands. In particular, the proliferation of numerous small and financially nonviable systems is a problem. In response, there are many proponents of mergers and acquisitions in water supply so that any potential economies of scope (in production or even management) are realized. Restructuring the industry may prove as important as pricing reform to its long-term viability. Included in structural issues are bypass through self supply and the purchase of bottled water.

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[1] Janice A. Beecher and Ann P. Laubach, *Compendium on Water Supply, Drought, and Conservation* (Columbus, OH: The National Regulatory Research Institute, 1989).

Even more important may be technological innovations--especially in water treatment for small systems--that improve the economic situation of individual providers faced with specific supply issues. Portable, affordable treatment systems for small water suppliers may help mitigate the impact of safe drinking water regulations. Interconnecting water systems combines structural and technological solutions that may improve the viability of some systems. However, such solutions are partially dependent on pricing and the assurance of an adequate revenue stream to the water system for adopting these innovations. Management, planning, and cost recovery policies may help promote long-term efficiency through the adoption of innovative technologies.

Regulation by state commissions is imperfect but essential to preventing the abuse of monopoly power. Efficiency and effectiveness of regulation can be improved in a variety of ways.[2] Also, price regulation may not be viewed as necessary for some water utilities. However, one possibility for improving water pricing generally is to expand regulatory authority so that some state or regional oversight is provided to municipalities and other local ratemaking bodies. Such oversight helps remove ratemaking from local political pressures, where incentives to keep prices down may dominate the goals of cost-based ratemaking. State commission regulation has the advantage of being a centralized source of technical regulatory expertise. Thus, the long-term interest in pricing may involve regulatory restructuring as well.

Some Evaluation Criteria

As alternatives in cost allocation and rate design for water utilities are considered, an analytical framework tailored to the particular needs of utilities or regulators can be a useful tool.

A simple framework was introduced in chapter 1. That framework suggested that in considering ratemaking and changes therein, the analyst may seek to compare the perspectives of utilities, consumers, and society as a whole, recognizing that each encompasses different types of goals. Often, conflicts emerge over specific issues because these goals are difficult to reconcile. Incremental-cost

2 Janice A. Beecher and Patrick C. Mann, *Deregulation and Regulatory Alternatives for Water Utilities* (Columbus, OH: The National Regulatory Research Institute, 1990).

pricing, for example, may meet society's criterion of economic efficiency (and more than meet utility revenue requirements) while resulting in rates perceived as "unaffordable" by consumers. Only the rarest cost allocation and rate design method will achieve a balanced solution that is actually satisfactory from all three perspectives. It is instead an exercise in optimization, with the explicit knowledge that some goals are partially sacrificed in the interest of achieving others.

On the choice of particular methods, chapter 4 developed an evaluation framework for marginal-cost pricing emphasizing four general issues: allocative efficiency, cost and rate stability, financial viability, and administrative feasibility. Associated with each are several issues related to the practical application of pricing theory. These also may be used in evaluating cost allocation and rate design alternatives. Once again, tradeoffs among competing goals are readily apparent. For example, while the uniform rate structure may be administratively simple, it may be deficient in terms of allocative efficiency or ensuring the long-term viability of the water utility. It is a matter of policy, of course, to determine which criterion is more important than another.

Perhaps most difficult to reconcile are quantitative and qualitative evaluation criteria. In the end, revenue requirements are far easier to estimate than, say, the affordability of water bills. There may be a temptation to use mainly quantifiable indicators of success or failure and avoid the less quantifiable. Yet cost allocation and rate design cannot occur in a vacuum. It may seem necessary at times to relax cost-of-service criteria in the interest of consumer understanding and acceptance, particularly if perceptions of equity are at stake. However, once the door is open to subjective criteria in ratemaking, it is difficult to keep political and other influences out of the process. Subjective criteria, then, must be used with caution.

It may be useful to develop evaluation criteria for cost allocation and rate design in the context of a planning framework. As already noted, pricing is clearly associated with planning. The interest in least-cost planning for all public utilities--water utilities included--continues to rise. The planning process not only serves to identify trends in supply and demand and future capacity options, but to identify the goals and priorities of the water utility. Pricing alternatives can be assessed in these terms. Likewise, long-term planning must take into account the role of price.

Some Research Needs

Public utility regulation clearly has not identified an ideal solution to the cost allocation and rate design puzzle, in part because no single solution exists. Further research will play a role in the evolution of approaches.

In general, the issues of value, cost, and price and their interconnections merit further analysis. Water's global abundance can be deceptive. Growing populations have placed stress on the hydrological system both in terms of quality and quantity. In theory, pricing can improve the allocation of water resources. The economic, operational, and cost characteristics of the public water supply industry could be better understood, particularly its differences and similarities compared to other public utilities. Cost allocation for water utilities requires further refinement. A pressing need exists for the development of cost allocators founded in empirical observation. Engineering process models, econometric models, optimization or simulation models, and other methods can be appropriately applied to the analysis of costs and their causes. Rate design for water utilities is an obvious choice for further research. Attention may be especially needed in understanding how well rate design alternatives meet different policy goals as well as how they satisfy revenue requirements. The issues of financial viability for water providers and affordability for water consumers may emerge as some of the most important research topics. In sum, cost allocation and rate design for water utilities now merit a prominent place on the regulatory research agenda.

APPENDIX A

NARUC UNIFORM SYSTEM OF ACCOUNTS FOR CLASS A WATER UTILITIES

BALANCE SHEET ACCOUNTS

Assets and Other Debts

Utility Plant

101. Utility Plant in Service
102. Utility Plant Leased to Other
103. Property Held for Future Use
104. Utility Plant Purchased or Sold
105. Construction Work in Progress
106. Completed Construction Work Not Classified
108. Accumulated Depreciation
    - 108.1 Accumulated Depreciation of Utility Plant in Service
    - 108.2 Accumulated Depreciation of Utility Plant Leased to Others
    - 108.3 Accumulated Depreciation of Property Held for Future Use
110. Accumulated Amortization
    - 110.1 Accumulated Amortization of Utility Plant in Service
    - 110.2 Accumulated Amortization of Utility Plant Leased to Others
114. Utility Plant Acquisition Adjustments
115. Accumulated Amortization of Utility Plant Acquisition Adjustments
116. Other Utility Plant Adjustments

Other Property and Investments

121. Nonutility property
122. Accumulated Depreciation and Amortization of Nonutility Property
123. Investment in Associated Companies
124. Utility Investments
125. Other Investments
126. Sinking Funds
127. Other Special Funds

Current and Accrued Assets

131. Cash
    - 131.1 Cash on Hand
    - 131.2 Cash in Bank
132. Special Deposits
133. Other Special Deposits
134. Working Funds
135. Temporary Cash Investments
141. Customer Accounts Receivable
142. Other Accounts Receivable
143. Accumulated Provision for Uncollectible Accounts--Cr.

144. Notes Receivable
145. Accounts Receivable from Associated Companies
146. Notes Receivable from Associated Companies
151. Plant Material and Supplies
152. Merchandise
153. Other Material and Supplies
161. Stores Expense
162. Prepayments
171. Accrued Interest and Dividends Receivable
172. Rents Receivable
173. Accrued Utility Revenues
174. Miscellaneous Current and Accrued Assets

Deferred Debits

181. Unamortized Debt Discount and Expense
182. Extraordinary Property Losses
183. Preliminary Survey and Investigation Charges
184. Clearing Accounts
185. Temporary Facilities
186. Miscellaneous Deferred Debits
    186.1 Deferred Rate Case Expense
    186.2 Other Deferred Debits
187. Research and Development Expenditures
190. Accumulated Deferred Income Taxes
    190.1 Federal
    190.2 State
    190.3 Local

Equity Capital and Liabilities

Equity Capital

201. Common Stock Issued
202. Common Stock Subscribed
203. Common Stock Liability for Conversion
204. Preferred Stock Issued
205. Preferred Stock Subscribed
206. Preferred Stock Liability for Conversion
207. Premium on Capital Stock
209. Reduction in Par or Stated Value of Capital Stock
210. Gain on Resale or Cancellation of Reacquired Capital Stock
211. Other Paid-In Capital
212. Discount on Capital Stock
213. Capital Stock Expense
214. Appropriated Retained Earnings
215. Unappropriated Retained Earnings
216. Reacquired Capital Stock
218. Proprietary Capital (for proprietorships and partnerships only)

Long-Term Debt

221. Bonds
222. Reacquired Funds
223. Advances from Associated Companies
224. Other Long-Term Debt

Current and Accrued Liabilities

231. Accounts Payable
232. Notes Payable
233. Accounts Payable to Associated Companies
234. Notes Payable to Associated Companies
235. Customer Deposits
236. Accrued Taxes
    - 236.1 Accrued Taxes, Utility Operating Income
        - 236.11 Accrued Taxes, Taxes Other Than Income
        - 236.12 Accrued Taxes, Income Taxes
237. Accrued Interest
    - 237.1 Accrued Interest on Long-Term Debt
    - 237.2 Accrued Interest on Other Liabilities
238. Accrued Dividends
239. Matured Long-Term Debt
240. Matured Interest
241. Miscellaneous Current and Accrued Liabilities

Deferred Credits

251. Unamortized Premium on Debt
252. Advances for Construction
253. Other Deferred Credits
255. Accumulated Deferred Investment Tax Credits
    - 255.1 Accumulated Deferred Investment Tax Credits, Utility Operations
    - 255.2 Accumulated Deferred Investment Tax Credits, Nonutility Operations

Operating Reserves

261. Property Insurance Reserve
262. Injuries and Damages Reserve
263. Pensions and Benefits Reserve
265. Miscellaneous Operating Reserves

Contributions in Aid of Construction

271. Contributions in Aid of Construction
272. Accumulated Amortization of Contributions in Aid of Construction

Accumulated Deferred Income Taxes

281. Accumulated Deferred Income Taxes -- Accelerated Amortization
282. Accumulated Deferred Income Taxes -- Liberalized Depreciation
283. Accumulated Deferred Income Taxes -- Other

WATER UTILITY PLANT ACCOUNTS

301. Organization (301.1)
302. Franchises (302.1)
303. Land and Land Rights (303.2 - 303.5)
304. Structures and Improvements (304.2 - 304.5)
305. Collecting and Impounding Reservoirs (305.2)
306. Lake, River, and Other Intakes (306.2)
307. Wells and Springs (307.2)
308. Infiltration Galleries and Tunnels (308.2)
309. Supply Mains (309.2)
310. Power Generation Equipment (310.2)
311. Pumping Equipment (311.2)
320. Water Treatment Equipment (320.3)
330. Distribution Reservoirs and Standpipes (330.4)
331. Transmission and Distribution Mains (331.4)
333. Services (333.4)
334. Meters and Meter Installation (334.4)
335. Hydrants (335.4)
339. Other Plant and Miscellaneous Equipment (339.1 - 339.4)
340. Office Furniture and Equipment (340.5)
341. Transportation (341.5)
342. Stores Equipment (342.5)
343. Tools, Shop and Garage Equipment (343.5)
344. Laboratory Equipment (344.5)
345. Power Operated Equipment (345.5)
346. Communications Equipment (346.5)
347. Miscellaneous Equipment (347.5)
348. Other Tangible Plant (348.5)

Water Utility Plant Subaccounts (as applicable)

- .1 Intangible Plant
- .2 Source of Supply and Pumping Plant
- .3 Water Treatment Plant
- .4 Transmission and Distribution Plant
- .5 General Plant

INCOME ACCOUNTS

Utility Operating Income

400. Operating Revenues
401. Operating Expenses
403. Depreciation Expense
406. Amortization of Utility Plant Acquisition Adjustment
407. Amortization Expense
    - 407.1 Amortization of Limited Term Plant
    - 407.2 Amortization of Property Losses
    - 407.3 Amortization of Other Utility Plant
408. Taxes Other Than Income
    - 408.10 Utility Regulatory Assessment Fees
    - 408.11 Property Taxes
    - 408.12 Payroll Taxes
    - 408.13 Other Taxes and Licenses
409. Income Taxes
    - 409.10 Federal Income Taxes, Utility Operating Income
    - 409.11 State Income Taxes, Utility Operating Income
    - 409.12 Local Income Taxes, Utility Operating Income
410. Provision for Deferred Income Taxes -- Credit
    - 411.10 Provision for Deferred Income Taxes -- Credit, Utility Operating Income
412. Investment Tax Credits
    - 412.10 Investment Tax Credits Deferred to Future Periods, Utility Operations
    - 412.11 Investment Tax Credits Restored to Operating Income, Utility Operations
413. Income from Utility Plant Leased to Others
414. Gains (Losses) from Disposition of Utility Property

Other Income and Deductions

415. Revenues from Merchandising, Jobbing and Contract Work
416. Costs and Expenses of Merchandising, Jobbing and Contract Work
419. Interest and Dividend Income
420. Allowance for Funds Used During Construction
421. Nonutility Income
426. Miscellaneous Nonutility Expenses

Taxes Applicable to Other Income and Deductions

408. Taxes Other Than Income
    - 408.20 Taxes Other Than Income, Other Income and Deductions
409. Income Taxes
    - 409.20 Income Taxes, Other Income and Deductions
410. Provision for Deferred Income Taxes
    - 410.20 Provision for Deferred Income Taxes, Other Income Deductions
411. Provision for Deferred Income Taxes -- Credit

411.20 Provisions for Deferred Income Taxes -- Credit, Other Income and Deductions

412. Investment Tax Credits
    - 412.20 Investment Tax Credits -- Net, Nonutility Operations
    - 412.30 Investment Tax Credits Restored to Nonoperating Income, Utility Operations

Interest Expense

427. Interest Expense
    - 427.1 Interest on Debt to Associated Companies
    - 427.2 Interest on Short-Term Debt
    - 427.3 Interest on Long-Term Debt
    - 427.4 Interest on Customer Deposits
    - 427.5 Interest -- Other
428. Amortization of Debt Discount and Expense
429. Amortization of Premium on Debt

Extraordinary Items

433. Extraordinary Income
434. Extraordinary Deductions
409. Income Taxes
    - 409.30 Income Taxes, Extraordinary Items

RETAINED EARNINGS ACCOUNTS

435. Balance Transferred From Income
436. Appropriations of Retained Earnings
437. Dividends Declared -- Preferred Stock
438. Dividends Declared -- Common Stock
439. Adjustments to Retained Earnings

WATER OPERATING REVENUE ACCOUNTS

Water Sales

460. Unmetered Water Revenue
461. Metered Water Revenue
    - 461.1 Metered Sales to Residential Customers
    - 461.2 Metered Sales to Commercial Customers
    - 461.3 Metered Sales to Industrial Customers
    - 461.4 Metered Sales to Public Authorities
    - 461.5 Metered Sales to Multiple Family Dwellings
462. Fire Protection Revenue
    - 462.1 Public Fire Protection
    - 462.2 Private Fire Protection
464. Other Sales to Public Authorities

465. Sales to Irrigation Customers
466. Sales for Resale
467. Interdepartmental Sales

Other Water Revenues

470. Forfeited Discounts
471. Miscellaneous Service Revenues
472. Rents From Water Property
473. Interdepartmental Rents
474. Other Water Revenues

WATER OPERATION AND MAINTENANCE EXPENSE ACCOUNTS

601. Salaries and Wages -- Employees (601.1 - 601.8)
603. Salaries and Wages -- Officers, Directors, and Majority Stockholders (603.1 - 603.8)
604. Employee Pensions and Benefits (604.1 - 604.8)
610. Purchased Water (610.1)
615. Purchased Power (615.1, 615.3, 615.5, 615.7, 615.8)
616. Fuel for Power Production (616.1, 616.3, 616.5, 616.7, 616.8)
618. Chemicals (618.1 - 618.8)
620. Materials and Supplies (620.1 - 620.8)
631. Contractual Services -- Engineering (631.1 - 631.8)
632. Contractual Services -- Accounting (632.1 -632.8)
633. Contractual Services -- Legal (633.1 - 633.8)
634. Contractual Services -- Management Fees (634.1 - 634.8)
635. Contractual Services -- Other (635.1 - 635.8)
641. Rental of Building/Real Property (641.1 - 641.8)
642. Rental of Equipment (642.1 - 642.8)
650. Transportation Expenses (650.1 - 650.8)
656. Insurance -- Vehicle (656.1 - 656.8)
657. Insurance -- General Liability (657.1 - 657.8)
658. Insurance -- Workman's Compensation (658.1 - 658.8)
659. Insurance -- Other (659.1 - 659.8)
660. Advertising Expense (660.8)
666. Regulatory Commission Expenses -- Amortization of Rate Case Expense (666.8)
667. Regulatory Commission Expenses -- Other (667.1 - 667.8)
670. Bad Debt Expense (670.7)
675. Miscellaneous Expenses (675.1 - 675.8)

Water Operation and Maintenance Expense Subaccounts (as applicable)

.1 Source of Supply and Expenses -- Operations
.2 Source of Supply and Expenses -- Maintenance
.3 Water Treatment Expenses -- Operations
.4 Water Treatment Expenses -- Maintenance
.5 Transmission and Distribution -- Operations
.6 Transmission and Distribution -- Maintenance
.7 Customer Accounts -- Expenses
.8 Administration and General Expenses

APPENDIX B

AN EXAMPLE OF THE COMMODITY-DEMAND COST ALLOCATION METHOD

TABLE B-1. Allocation of Plant Value
Commodity-Demand Method

Item	Total	Commodity	Demand: Maximum Day	Demand: Maximum Hour	Customer Meters & Services	Direct Fire-Protection Service
Source-of-supply plant:						
Land and land rights	$ 423,000	$ 423,000				
Reservoir	204,000	204,000				
Pumping plant:						
Raw water pumping and transmission lines	114,000		$ 114,000			
Treated-water pumping	425,000		425,000			
Treatment plant	1,048,000		1,048,000			
Transmission and distribution plant:						
Structures and improvements	40,000			$ 30,000	$ 9,000	$ 1,000
Distribution storage	413,000			413,000		
Transmission mains	3,112,000			3,112,000		
Distribution mains	1,830,000			1,830,000		
Meters	472,000				472,000	
Services	1,078,000				1,078,000	
Fire hydrants	248,000					248,000
General plant:						
Office	186,000	12,000	31,000	107,000	31,000	5,000
Vehicles	17,000	1,000	3,000	10,000	3,000	
Other	141,000	9,000	24,000	81,000	23,000	4,000
Total plant value	9,751,000	649,000	1,645,000	5,583,000	1,616,000	258,000
Less: Contributions in aid of construction	750,000				750,000	
Rate base	$9,001,000	$ 649,000	$1,645,000	$5,583,000	$ 866,000	$ 258,000

Source: American Water Works Association; Water Rates (Denver, CO: American Water Works Association, Manual M1, 1983), 19.

TABLE B-2. Allocation of Depreciation Expense
Commodity-Demand Method

Item	Total	Commodity	Demand		Customer Meters & Services	Direct Fire-Protection Service
			Maximum Day	Maximum Hour		
Source-of-supply plant:						
Land and land rights						
Reservoir	$ 3,200	$ 3,200				
Pumping plant:						
Raw water pumping and transmission lines	3,500		$ 3,500			
Treated-water pumping	14,200		14,200			
Treatment plant	28,000		28,000			
Transmission and distribution plant:						
Structures and improvements	1,100			$ 600	$ 400	$ 100
Distribution storage	10,300			10,300		
Transmission mains	37,500			37,500		
Distribution mains	32,500			32,500		
Meters	22,500				22,500	
Services	33,200				33,200	
Fire hydrants	8,300					8,300
General plant:						
Office	4,600	100	1,100	1,900	1,300	200
Vehicles	4,000	100	900	1,600	1,200	200
Other	10,100	200	2,400	4,200	2,900	400
Total depreciation expense	$213,000	$ 3,600	$ 50,100	$ 88,600	$ 61,500	$ 9,200

Source: American Water Works Association; Water Rates (Denver, CO: American Water Works Association, Manual M1, 1983), 20.

TABLE B-3. Allocation of Operation-and-Maintenance Expense
Commodity-Demand Method

Item	Total	Commodity	Demand: Maximum Day	Demand: Maximum Hour	Customer Costs: Meters & Services	Customer Costs: Billing Collecting	Direct Fire Protection Service
Source-of-supply	$ 17,000	$ 17,000					
Pumping:							
Power	152,700	108,400	$ 44,300				
Other	107,400		107,400				
Total	260,100	108,400	151,700				
Treatment:							
Chemicals	99,900	99,900					
Other	69,600		69,600				
Total	169,500	99,900	69,600				
Transmission and distribution:							
Distribution storage	14,000			$ 14,000			
Transmission mains	54,100			54,100			
Distribution mains	35,200			35,200			
Meters	96,600				$ 96,600		
Services	35,300				35,300		
Fire hydrants	16,500						$ 16,500
Other	60,000			24,600	31,500		3,900
Total	311,700			127,900	163,400		20,400
General billing and collecting:							
Meter reading	110,800					$ 110,800	
Billing and collecting	203,700					203,700	
Other	11,800					11,800	
Total	326,300					326,300	
Administration and general:							
Fringe benefits	81,800	2,300	25,000	13,200	16,000	22,600	2,700
Other	303,600	6,400	67,100	46,900	59,600	115,900	7,700
Total	385,400	8,700	92,100	60,100	75,600	138,500	10,400
Total operation-and-maintenance expense	$1,470,000	$ 234,000	$ 313,400	$ 188,000	$ 239,000	$ 464,800	$ 30,800

Source: American Water Works Association; Water Rates (Denver, CO: American Water Works Association, Manual M1, 1983), 21.

TABLE B-4. Unit Costs of Service
Commodity-Demand Method

Item	Total Cost	Commodity	Demand: Maximum Day	Demand: Maximum Hour	Customer Costs: Meters & Services	Customer Costs: Billing Collecting	Direct Fire Service
Total system units of service:							
Number		2,877,000	16,563	29,632	18,159	203,136	
Units		thou. gal	thou. gpd	thou. gpd	equiv. meters	bills	
Operation-and-maintenance expense:							
Total	$1,470,000	$234,00	$313,400	$188,000	$239,000	$464,800	$30,800
Unit cost ($ unit)		0.0813	18.9217	6.3445	13.1615	2.2881	
Depreciation expense:							
Total	$213,000	$3,600	$50,100	$88,600	$61,500		$9,200
Unit cost ($ unit)		0.0013	3.0248	2.9900	3.3868		
Rate Base:							
Total rate base	$9,001,000	$649,000	$1,645,000	$5,583,000	$866,000		$258,000
Unit rate base ($ unit)		0.2256	99.3178	188.4112	47.6899		
Payment in lieu of taxes:							
Total	$175,000	$12,600	$32,000	$108,600	$16,800		$5,000
Unit cost ($ unit)		0.0044	1.9320	3.6650	0.9252		
Unit return on rate base:							
Inside-city ($ unit) *		0.0107	4.6977	8.9118	2.2557		$12,000
Outside-city ($ unit) **		0.0169	7.4488	14.1308	3.5767		
Total unit costs of service:							
Inside-city ($ unit)		0.0977	28.5762	21.9113	19.7292	2.2881	
Outside-city ($ unit)		0.1039	31.3273	27.1303	21.0502	2.2881	

* At 4.73 percent return on $8,420,000 rate base.
** At 7.5 percent return on $583,000 rate base.
Source: American Water Works Association; Water Rates (Denver, CO: American Water Works Association, Manual M1, 1983), 34.

TABLE B-5. Cost Distribution to Customer Classes
Commodity-Demand Method

Item	Commodity	Demand: Maximum Day	Demand: Maximum Hour	Customer Costs: Meters & Services	Customer Costs: Billing & Collecting	Direct Fire-Protection Service	Total Cost of Service
Inside-city:							
Unit cost of service ($ unit)	0.0977 per thou. gal	28.5762 per thou. gpd	21.9113 per thou. gpd	19.7292 per equiv. meter	2.2881 per bill		
Retail service:							
Residential:							
Units of service	928,000	6,355	10,168	16,019	190,452		
Allocated cost of service	$ 90,700	$ 181,600	$ 222,800	$ 316,100	$ 435,800		$1,247,000
Commercial:							
Units of service	590,000	3,232	5,252	1,951	12,528		
Allocated cost of service	$ 57,600	$ 92,400	$ 115,100	$ 38,500	$ 28,700		$ 332,300
Industrial:							
Units of service	1,149,000	4,722	6,296	169	120		
Allocated cost of service	$ 112,300	$ 134,900	$ 138,000	$ 3,300	$ 300		$ 388,800
Fire-protection service:							
Units of service		960	5,760				
Allocated cost of service		$ 27,400	$ 126,200			$ 57,000	$ 210,600
Total inside-city allocated cost of service							$2,178,700
Outside-city:							
Unit costs of service ($ unit)	0.1039	31.32773	27.1303	21.0502	2.2881		
Wholesale:							
Units of service	210,000	1,294	2,156	20	36		
Allocated cost of service	$ 21,800	$ 40,500	$ 58,500	$ 400	$ 100		$ 121,300
Total system allocated cost of service	$ 282,400	$ 476,800	$ 660,600	$ 358,300	$ 464,900	$ 57,000	$2,300,000

Source: American Water Works Association; Water Rates (Denver, CO: American Water Works Association, Manual M1, 1983), 36.

APPENDIX C

AN EXAMPLE OF THE
BASE-EXTRA CAPACITY COST ALLOCATION METHOD

TABLE C-1. Allocation of Plant Value
Base-Extra Capacity Method

Item	Total	Base	Extra Capacity Maximum Day	 Maximum Hour	Customer Meters & Services	Direct Fire Service
Source-of-supply plant:						
Land and land rights	$ 423,000	$ 423,000				
Reservoir	204,000	204,000				
Pumping plant:						
Raw water pumping and transmission lines	114,000	74,000	$ 40,000			
Treated-water pumping	425,000	276,000	149,000			
Treatment plant	1,048,000	681,000	367,000			
Transmission and distribution plant:						
Structures and improvements	40,000	13,000		$ 17,000	$ 9,000	$1,000
Distribution storage	413,000	41,000		372,000		
Transmission mains	3,112,000	1,400,000		1,712,000		
Distribution mains	1,830,000	824,000		1,006,000		
Meters	472,000				472,000	
Services	1,078,000				1,078,000	
Fire hydrants	248,000					248,000
General plant:						
Office	186,000	78,000	11,000	61,000	31,000	5,000
Vehicles	17,000	7,000	1,000	6,000	3,000	.
Other	141,000	59,000	8,000	47,000	23,000	4,000
Total plant value	9,751,000	4,080,000	576,000	3,221,000	1,616,000	258,000
Less: Contributions in aid of construction	750,000				750,000	
Rate base	$9,001,000	$4,080,000	$ 576,000	$3,221,000	$ 866,000	$ 258,000

Source: American Water Works Association; Water Rates (Denver, CO: American Water Works Association, Manual M1, 1983), 14.

TABLE C-2. Allocation of Depreciation Expense
Base-Extra Capacity Method

Item	Total	Base	Extra Capacity Maximum Day	Extra Capacity Maximum Hour	Customer Meters & Services	Direct Fire Service
Source-of-supply plant:						
Land and land rights						
Reservoir	$ 3,200	$ 3,200				
Pumping plant:						
Raw water pumping and transmission lines	3,500	2,300	$ 1,200			
Treated-water pumping	14,200	9,200	5,000			
Treatment plant	28,000	18,200	9,800			
Transmission and distribution plant:						
Structures and improvements	1,100	200		$ 400	$ 400	$ 100
Distribution storage	10,300	1,000		9,300		
Transmission mains	37,500	16,900		20,600		
Distribution mains	32,500	14,600		17,900		
Meters	22,500				22,500	
Services	33,200				33,200	
Fire hydrants	8,300					8,300
General plant:						
Office	4,600	1,600	400	1,100	1,300	200
Vehicles	4,000	1,400	300	1,000	1,100	200
Other	10,100	3,400	800	2,500	3,000	400
Total depreciation expense	$213,000	$ 72,000	$ 17,500	$ 52,800	$ 61,500	$ 9,200

Source: American Water Works Association; Water Rates (Denver, CO: American Water Works Association, Manual M1, 1983), 16.

TABLE C-3. Allocation of Operation-and-Maintenance Expense
Base-Extra Capacity Method

Item	Total	Base	Extra Capacity: Maximum Day	Extra Capacity: Maximum Hour	Customer Costs: Meters & Services	Customer Costs: Billing & Collecting	Direct Fire Service
Source-of-supply	$ 17,000	$ 17,000					
Pumping:	152,700	137,400	$ 15,300				
Other	107,400	69,800	37,600				
Total	260,100	207,200	52,900				
Treatment:							
Chemicals	99,900	99,900					
Other	69,600	45,200	24,400				
Total	169,500	145,100	24,400				
Transmission and distribution:							
Distribution storage	14,000	1,400		$ 12,600			
Transmission mains	54,100	24,300		29,800			
Distribution mains	35,200	15,800		19,400			
Meters	96,600				$ 96,600		
Services	35,300				35,300		
Fire hydrants	16,500						$ 16,500
Other	60,000	9,900		14,700	31,500		3,900
Total	311,700	51,400		76,500	163,400		20,400
General billing and collecting:							
Meter reading	110,800					$110,800	
Billing and collecting	203,700					203,700	
Other	11,800					11,800	
Total	326,300					326,300	
Administration and general:							
Fringe benefits	81,800	24,400	8,700	7,400	16,000	22,600	2,700
Other	303,600	69,000	23,500	27,900	59,600	115,900	7,700
Total	385,400	93,400	32,200	35,300	75,600	138,500	10,400
Total operation-and-maintenance expense	$1,470,000	$ 514,100	$ 109,500	$ 111,800	$ 239,000	$ 464,800	$ 30,800

Source: American Water Works Association; Water Rates (Denver, CO: American Water Works Association, Manual M1, 1983), 17.

TABLE C-4. Units of Service
Base-Extra Capacity Method

	Base		Maximum-Day			Maximum-Hour				
Customer Class	Annual Use thou. gal	Average Rate thou. gpd	Capacity Factor %	Total Capacity thou. gpd	Extra Capacity thou. gpd	Capacity Factor %	Total Capacity thou. gpd	Extra Capacity thou. gpd	Equivalent Meters and Services	Bills
Inside-city:										
Retail service										
Residential	928,000	2,542	250	6,355	3,813	400	10,168	7,626	16,019	190,452
Commercial	590,000	1,616	200	3,232	1,616	325	5,252	3,636	1,951	12,528
Industrial	1,149,000	3,148	150	4,722	1,574	200	6,296	3,148	169	120
Fire-protection service				960	960		5,760	5,760		
Total inside-city	2,667,000	7,306		15,269	7,963		27,476	20,170	18,139	203,100
Outside-city:										
Wholesale service	210,000	575	225	1,294	719	375	2,156	1,581	20	36
Total system	2,877,000	7,881		16,563	8,682		29,632	21,751	18,159	203,136

Source: American Water Works Association; Water Rates (Denver, CO: American Water Works Association, Manual M1, 1983), 29.

TABLE C-5. Cost Distribution to Customer Classes
Base-Extra Capacity Method

Item	Base	Extra Capacity: Maximum Day	Extra Capacity: Maximum Hour	Customer Costs: Meters & Services	Customer Costs: Billing Collecting	Direct Fire-Protection Service	Total Cost of Service
Inside-city:							
Unit costs of service ($/unit)	0.2984 per thou. gal	19.0561 per thou. gpd	17.4545 per thou. gpd	19.7292 per equiv. meter	2.2881 per bill		
Retail service:							
Residential:							
Units of service	928,000	3,813	7,626	16,019	190,452		
Allocated cost of service	$ 276,900	$ 72,700	$ 133,100	$ 316,100	$ 435,800		$1,234,600
Commercial:							
Units of service	590,000	1,616	3,636	1,951	12,528		
Allocated cost of service	$ 176,100	$ 30,800	$ 63,500	$ 38,500	$ 28,700		$ 337,600
Industrial:							
Units of service	1,149,000	1,574	3,148	169	120		
Allocated cost of service	$ 342,900	$ 30,000	$ 54,900	$ 3,300	$ 300		$ 431,400
Fire-protection service:							
Units of service		960	5,760				
Allocated cost of service		$ 18,300	$ 100,600			$ 57,000	$ 175,900
Total inside-city allocated cost of service							$2,179,500
Outside-city:							
Unit cost of service ($/unit)	0.3377	20.8938	21.5565	21.0502	2.2881		
Wholesale:							
Units of service	210,000	719	1,581	20	36		
Allocated cost of service	$ 70,900	$ 15,000	$ 34,100	$ 400	$ 100		$ 120,500
Total system allocated cost of service	$ 866,800	$ 166,800	$ 386,200	$ 358,300	$ 464,900	$ 57,000	$2,300,000

Source: American Water Works Association; Water Rates (Denver, CO: American Water Works Association, Manual M1, 1983), 35.

APPENDIX D

AN EXAMPLE OF MARGINAL-COST ANALYSIS

TABLE D-1

UNIT MARGINAL COST BY CUSTOMER CLASSIFICATION

	Annual Marginal Cost	Effective Sales (TG's)	Unit Marginal Cost
Residential:			
A. Supply	$106,129	118,443	$0.90
B. Pumping	50,134	118,443	0.42
C. Treatment	22,143	118,443	0.19
D. Storage	48,079	84,607	0.57
TOTAL	$226,486		$2.08
Commercial:			
A. Supply	$106,129	148,081	$0.72
B. Pumping	50,134	148,081	0.34
C. Treatment	22,143	148,081	0.15
D. Storage	48,079	105,777	0.45
TOTAL	$226,486		$1.66
Other Industrial:			
A. Supply	$106,129	169,214	$0.63
B. Pumping	50,134	169,214	0.30
C. Treatment	22,143	169,214	0.13
D. Storage	48,079	131,619	0.37
TOTAL	$226,486		$1.43
Large Industrial:			
A. Supply	$106,129	211,518	$0.50
B. Pumping	50,134	211,518	0.24
C. Treatment	22,143	211,518	0.10
D. Storage	48,079	164,506	0.29
TOTAL	$226,486		$1.13
Public Authorities:			
A. Supply	$106,129	148,081	$0.72
B. Pumping	50,134	148,081	0.34
C. Treatment	22,143	148,081	0.15
D. Storage	48,079	105,777	0.45
TOTAL	$226,486		$1.66

Source: Massachusetts-American Water Company Exhibit SBA-4 in a rate hearing before the Massachusetts Department of Public Utilities (June 1990).

TABLE D-2

EFFECTIVE SALES AND PRODUCTION DATA FOR MARGINAL-COST STUDY

Effective Sales By Class	Demand Ratio	Sales Ratio	Annual Sales Per MGD of Capacity
Residential			
Max Day	2.50	0.3245	118,443
Peak Hour	3.50	0.2318	84,607
Commercial			
Max Day	2.00	0.4057	148,081
Peak Hour	2.80	0.2898	105,777
Other Industrial			
Max Day	1.75	0.4636	169,214
Peak Hour	2.25	0.3606	131,619
Large Industrial			
Max Day	1.40	0.5795	211,518
Peak Hour	1.80	0.4507	164,506
Public Authorities			
Max Day	2.00	0.4057	148,081
Peak Hour	2.80	0.2898	105,777

TOTAL PRODUCTION:	Average Day	5.51 mgd
	Annual Volume	2,011,150 TGs
Company Use & Unaccounted For		379,483 TGs
Effective Total System Sales		1,631,667 TGs

Calculation of System Sales per 1.0 MGD of Additional Capacity

Ratio of Total System Sales to Total Production:		0.8113
System Demand Ratio	2.00	
System Sales Ratio	0.4057	
Annual System Sales per MGD of Capacity (TGs per year)		148,081

Source: Massachusetts-American Water Company Exhibit SBA-4 in a rate hearing before the Massachusetts Department of Public Utilities (June 1990).

TABLE D-3

ESTIMATED COST OF FACILITIES REQUIRED TO PROVIDE 1 MGD OF NEW CAPACITY

Facilities Required			Capital Costs
1.	Well:	Exploration & Development	$150,000
		Mass. DEP Permitting	25,000
		Structures & Appurtenances	25,000
			$200,000
2.	Pumping:	Structure	$100,000
		Equipment	50,000
			$150,000
3.	Treatment:	Equipment	$50,000
4.	Storage:	250,000 gallons (1)	$250,000
5.	Transmission Mains Required to connect new well and storage facilities to existing distribution network (2):		
		a. Well	$250,000
		b. Storage Tank (3)	$60,000
6.	Land for well site		$250,000
7.	Land for tank site (4)		$12,500

Notes:

(1) Based on 1 MG Structure costing $1,000,000. Volume required to equalize 1 MGD of maximum day demand is assumed to be 250,000 gallons or 25 percent of the total.

(2) Based on 2,500 ft. of 12" main at $100 per foot.

(3) Based on 25% of $250,000 for transmission main.

(4) Based on 25% of $50,000 for land.

Source: Massachusetts-American Water Company Exhibit SBA-4 in a rate hearing before the Massachusetts Department of Public Utilities (June 1990).

TABLE D-4

CALCULATION OF ANNUAL MARGINAL COST FOR FACILITIES REQUIRED TO PROVIDE ADDITIONAL CAPACITY

A. Supply	Capital Cost	Life Cycle	Present Value	Equal Periodic Payment
Well	$200,000	40	$264,449	$29,569
Transmission Main	250,000	100	343,418	37,811
Land	250,000	-	351,931	38,749
Total Fixed Costs	$700,000		$959,799	
Annual Marginal Cost - Supply				$106,129

B. Pumping	Capital Cost	Life Cycle	Present Value	Equal Periodic Payment
Structure	$100,000	50	$133,939	$14,827
Equipment	50,000	25	63,305	7,522
Total Fixed Costs	$150,000		$197,244	$22,349
Variable Costs:				
Power Purchased		$	282,249	
Maintenance of Equipment			23,906	
Total System			$306,155	
Effective Total System Sales (TG/YR)			1,631,667	
Unit Variable Cost				27,785
Annual Marginal Cost - Pumping				$50,134

TABLE D-4 (continued)

C. Treatment	Capital Cost	Life Cycle	Present Value	Equal Periodic Payment
Equipment	$50,000			
Total Fixed Costs	$50,000	20	$62,276	$7,825
Variable Costs:				
Chemicals			$147,649	
Maintenance of Equipment			10,116	
Total System			$157,765	
Effective Total System Sales (TG/YR)			1,631,667	
Unit Variable Cost			$0.10	
System Sales for IMGD Capacity			148,081	
Annual Variable Cost				14,318
Annual Marginal Cost - Treatment				$22,143

D. Storage	Capital Cost	Life Cycle	Present Value	Equal Periodic Payment
Storage Tank	$250,000	50	$334,847	$37,067
Transmission Main	60,000	100	82,420	9,075
Land	12,500	-	17,597	1,937
Total Fixed Costs	$322,500		$434,864	
Annual Marginal Cost - Storage				$48,079

TABLE D-4 (continued)

Supporting calculations:	
Land cost required for increased well capacity:	$250,000
Return at 11.01%	$27,525
Property Taxes at 1.147%	2,868
Income Taxes at 30.36%	8,356
Total Annual Cost (Equal Periodic Payment)	$38,749
Land cost required for increased storage capacity:	$12,500
Return at 11.01%	$1,376
Property Taxes at 1.147%	143
Income Taxes at 30.36%	418
Total Annual Cost (Equal Periodic Payment)	$1,937

Source: Massachusetts-American Water Company Exhibit SBA-4 in a rate hearing before the Massachusetts Department of Public Utilities (June 1990).

APPENDIX E

ERNST & YOUNG'S 1990 NATIONAL WATER RATE SURVEY

ERNST & YOUNG'S 1990 NATIONAL WATER RATE SURVEY

State City/ Effective Date	Bill-ing Cycle (a)	Rate Struc-ture (b)	Rates (cubic feet and thousand gallons)							Connec-tion Charge (c)
			5/8 meter				2 inch	4 inch	8 inch	
			0	500	1,000	3,000	50,000	1 mil	1.5 mil	
			0	3.74	7.48	22.44	374	7,480	11,220	
ALABAMA										
Birmingham	M	D5	$3.46	$7.71	$11.96	$28.84	$425	$7,887	$11,937	$145
Mobile (1/90)	M	D9	3.78	4.69	9.66	28.86	436	5,776	7,921	281
ARIZONA										
Phoenix (7/89)										
Summer	M	I3	4.70	6.80	8.90	25.30	445	7,264	na	varies
Winter	M	I3	4.70	6.80	8.90	22.20	387	7,264	na	varies
Tuscon (5/89)										
Summer	M	I7	4.10	9.05	15.00	52.15	564	9,533	14,336	400
Winter	M	I7	4.10	9.05	14.70	44.75	564	9,533	14,336	400
ARKANSAS										
Little Rock (2/85)	M	D5	3.60	5.82	9.52	24.32	318	3,168	4,684	120
CALIFORNIA										
Anaheim (9/89)	B,M	U	9.60	11.64	13.68	22.49	237	4,169	6,389	2,500
Bakersfield (1/89)	M	U	4.85	6.88	8.90	17.00	218	4,089	6,170	none
Fresno (12/89)	B	U	3.23	4.43	5.63	10.43	129	2,420	3,649	1,760
Los Angeles (10/88)										
Summer	M,B	U	5.30	7.52	12.65	33.15	525	10,297	15,540	1,455
Winter	M,B	U	5.30	6.85	11.30	29.10	457	8,947	13,515	1,455
Oakland (7/89)	B	U	4.20	7.20	12.20	28.20	424	8,080	12,264	1,480-7,820
Sacremento (1/89)	M	R: U C: D3	5.17	5.17	5.17	10.20	158	2,543	3,793	2,214
San Diego (1/89)	B	R: I2 C: U	3.12	7.64	12.16	31.92	504	9,749	14,846	1,651
San Francisco (7/89)	B,M	U	1.50	4.05	6.60	16.80	257	5,102	7,650	1,600
San Jose (7/89)										
City of San Jose	M	I	4.00	8.09	12.84	31.84	486	9,529	14,320	3,250
San Jose Water Co.	M	I	4.35	8.66	13.62	33.41	507	9,930	14,953	na
Stockton (8/89)	M	D2	5.75	7.35	8.95	15.35	167	2,757	4,165	359
Ventura (6/89)	B	I3	1.36	4.69	8.45	26.11	441	8,830	13,245	699
COLORADO										
Col. Springs (1/86)	M	U	2.74	9.67	16.59	44.30	695	13,856	20,782	3,807
Denver (4/87)	B	D4	2.15	5.25	8.36	19.58	208	3,571	5,358	2,730

State	Bill-	Rate	Rates (cubic feet and thousand gallons)							Connec-
City/	ing	Struc-	5/8 meter				2 inch	4 inch	8 inch	tion
Effective	Cycle	ture	0	500	1,000	3,000	50,000	1 mil	1.5 mil	Charge
Date	(a)	(b)	0	3.74	7.48	22.44	374	7,480	11,220	(c)
CONNECTICUT										
Hartford (3/89)	M,Q	I2	6.16	10.81	15.46	34.06	474	7,257	10,757	2,654
New Haven (11/88)	Q	D3	6.52	13.97	21.42	51.22	653	11,309	16,733	485
Bridgeport (6/89)	M,Q	D3	10.27	14.84	22.45	52.91	507	6,399	9,918	50
DISTRICT OF COLUMBIA										
Washington (10/86)	Q,M	U	0.00	5.02	10.04	30.12	502	10,040	15,060	78
FLORIDA										
Ft.Lauderdale (10/89)	B	U	2.73	6.81	10.88	27.19	425	8,206	12,397	426
Jacksonville (12/81)	M	I2	5.54	5.54	8.20	15.80	212	2,848	4,337	290
Lakeland (10/84)	M	D3	3.10	4.80	7.35	20.10	307	5,880	8,902	530
Miami (10/89)	Q	U	4.29	4.29	7.13	21.38	356	7,125	10,689	315+
Orlando (2/90)	M	D2	2.35	3.93	6.05	13.97	200	3,893	5,854	985
St. Petersburg (9/88)	M	R: I3 C: U	4.38	8.05	11.71	26.37	411	7,510	11,713	505
Tampa (10/89)	M	U	1.50	3.85	7.70	23.10	385	7,700	11,550	1,345
Palm Beach Co.(11/89)	M	R: I3 C: U	3.50	5.90	9.20	20.20	300	4,786	na	1,700
GEORGIA										
Atlanta (3/84)	B,M	D4	3.35	6.75	15.25	49.25	564	7,459	11,059	400+/ 620+
Augusta (1/80)	M	D5	2.88	3.59	7.18	21.54	301	4,195	6,065	425
HAWAII										
Honolulu (7/89)	B,M	U	1.63	5.51	9.95	26.60	418	8,306	12,457	2,325
ILLINOIS										
Chicago (5/89)	B,M,S	U	0.00	3.35	6.69	20.07	335	6,690	10,035	450
Joliet (4/85)	M	D3	2.55	6.96	14.31	41.51	587	11,607	17,407	110
Peoria (3/86)	M,Q	D4	5.00	13.15	21.30	53.90	427	6,412	9,668	0
INDIANA										
Gary (12/89)	B,M	D6	7.08	8.83	17.05	46.22	587	6,190	9,069	varies
Indianapolis (7/88)	M	D5	3.25	8.05	12.85	30.25	395	4,320	6,241	varies
Fort Wayne (8/86)	M	D3	3.59	7.13	10.67	24.83	346	4,427	6,557	412/ 587

APPENDIX E (continued)

State City/ Effective Date	Bill-ing Cycle (a)	Rate Struc-ture (b)	Rates (cubic feet and thousand gallons): 5/8 meter 0 / 0	500 / 3.74	1,000 / 7.48	3,000 / 22.44	2 inch 50,000 / 374	4 inch 1 mil / 7,480	8 inch 1.5 mil / 11,220	Connec-tion Charge (c)
IOWA										
Davenport (7/87)	Q	D4	3.35	7.96	12.57	31.01	368	6,179	8,728	0
Des Moines (1/88)	M	D	5.00	6.32	12.64	37.92	516	7,428	11,051	70+
KANSAS										
Wichita (1/87)	B	D	3.97	5.01	8.60	22.96	220	3,528	4,897	300
KENTUCKY										
Louisville (1/88)	M,B	I6	3.15	6.98	11.36	30.06	478	7,935	11,777	425
LOUISIANA										
Baton Rouge (6/89)	M	D5	7.23	8.98	13.37	30.91	344	4,147	5,867	74
New Orleans (1/87)	M	D3	2.80	9.57	16.53	40.54	628	9,848	14,630	0
Shreveport (1/89)	M	U	2.10	7.22	12.35	26.78	370	7,283	10,963	600
MARYLAND										
Baltimore (5/89)	Q	D3	2.33	3.50	7.00	17.40	175	2,977	4,452	0
MASSACHUSETTS										
Boston (1/90)	Q	I10	0.00	7.55	15.12	45.49	765	15,408	23,118	125
Salem (7/84)	Q	U	10.50	10.50	10.50	31.50	525	10,500	15,750	45+
Springfield (7/89)	Q	U	5.00	5.45	10.90	32.70	545	10,900	16,350	75+ 10/ft.
Lawrence (7/88)	Q	U	3.17	6.75	13.50	40.50	68	13,500	20,250	315
Worchester (7/89)	S	U	1.50	6.85	13.70	41.10	685	13,700	20,550	50
MICHIGAN										
Ann Arbor (7/85)	Q,M	U	2.10	4.10	8.19	24.57	410	8,190	12,285	1,005
Detroit (7/89)	Q,M	D3	0.88	3.02	5.17	13.75	191	3,341	5,039	0
Flint (7/89)	M	D3	3.40	9.35	15.30	45.35	604	9,676	14,401	70
Grand Rapids (1/89)	QM	U	6.05	9.05	12.05	24.05	337	6,145	9,324	3,538+
Lansing (11/86)	Q,M	U	4.15	8.38	12.60	29.50	462	8,616	13,256	1,836
Saginaw (11/89)	Q,M	D3	1.83	3.73	5.64	13.25	210	3,550	5,497	307
MINNESOTA										
Minneapolis (1/84)	Q	U	1.00	4.25	8.50	25.50	425	8,500	12,750	357
St. Paul (1/88)	Q,M	D3	1.07	5.57	10.07	28.07	460	8,757	13,182	1,096

State City/ Effective Date	Bill-ing Cycle (a)	Rate Struc-ture (b)	Rates (cubic feet and thousand gallons) 5/8 meter 0 / 0	500 / 3.74	1,000 / 7.48	3,000 / 22.44	2 inch 50,000 / 374	4 inch 1 mil / 7,480	8 inch 1.5 mil / 11,220	Connec-tion Charge (c)
MISSISSIPPI										
Jackson (6/88)	B	U	2.50	10.20	15.40	36.20	543	10,438	15,638	515
MISSOURI										
Kansas City (12/89)	B,M	D3	5.10	9.70	14.30	32.70	381	6,952	9,821	varies
St. Louis (9/89)	Q	D3	3.20	6.75	10.30	24.50	327	5,662	8,537	55
NEBRASKA										
Omaha (5/89)										
Summer	M	D2	2.10	4.71	7.72	20.18	275	4,528	6,713	613
Winter	M	D2	2.10	4.71	7.72	17.76	238	4,528	6,713	613
NEVADA										
Las Vegas (10/87)	M	U	8.66	11.39	14.12	25.04	324	5,614	8,677	400
NEW JERSEY										
Jersey City (1/82)	Q	U	1.00	4.75	8.50	23.50	383	7,530	11,340	190
Newark (2/84)	Q	D5	10.37	10.37	15.56	36.30	484	8,042	11,767	1,750
Trenton (3/84)	Q	D3	4.48	5.49	6.50	10.56	145	2,076	3,597	0
NEW MEXICO										
Albuquerque (9/88)	M	U	5.19	2.79	10.39	22.72	306	5,560	9,237	2,208
NEW YORK										
Albany (6/88)	T	I2	3.75	3.75	10.00	30.00	500	13,514	20,514	175
Buffalo (7/88)	M,Q	na	6.90	6.90	6.90	20.70	207	3,627	5,427	263
New York (1/89)	S,B	U	3.90	4.75	9.50	28.50	475	9,500	14,250	330
Syracuse (12/89)	Q,M	D4	3.59	4.15	8.30	24.90	301	5,260	7,065	235
NORTH CAROLINA										
Charlotte (7/89)	M	U	1.45	4.85	8.25	21.85	341	6,801	10,201	1,001
Greensboro (3/88)	M,Q	D3	1.98	3.30	6.60	19.80	234	2,894	4,294	1,643
Raleigh (8/89)	M	U	1.41	6.61	11.81	32.61	526	10,416	15,651	1,869

APPENDIX E (continued)

State City/ Effective Date	Billing Cycle (a)	Rate Structure (b)	Rates (cubic feet and thousand gallons) 5/8 meter 0 / 0	500 / 3.74	1,000 / 7.48	3,000 / 22.44	2 inch 50,000 / 374	4 inch 1 mil / 7,480	8 inch 1.5 mil / 11,220	Connection Charge (c)
OHIO										
Akron (1/90)	M	D3	2.02	9.37	16.72	46.12	610	11,820	18,004	785
Canton (10/88)	Q	D	2.00	4.55	9.10	27.30	313	4,038	5,738	250/ 265
Cincinnati (12/88)	Q,M	D3	3.53	5.11	9.06	23.56	341	5,974	8,978	1,500
Cleveland (2/87)	Q	I2	5.20	5.20	6.23	19.71	336	6,739	10,109	235
Columbus (1/89)	Q,M	D6	2.98	6.42	9.84	30.17	298	4,889	7,034	1,997
Dayton (10/87)	Q,M	D6	3.66	3.66	3.66	8.79	140	2,170	3,157	1,300+/-
Toledo (1/87)	Q,M	D4	4.03	4.03	6.05	18.15	295	4,822	6,703	600
Youngstown (5/88)	Q	D5	1.96	4.96	9.43	30.32	307	4,943	7,383	525
OKLAHOMA										
Oklahoma C. (7/88)	M	U	2.75	4.91	9.23	25.43	406	7,631	11,446	110+
Tulsa (1/90)	M	U	3.74	7.85	11.97	26.63	331	6.394	9,573	110+
OREGON										
Portland (7/89)	Q,M	U	2.80	6.40	10.00	24.40	369	7,221	10,857	610+
PENNSYLVANIA										
Allentown (1/89)	Q	U	2.52	6.04	9.55	23.62	362	7,068	10,648	90
Lancaster (1/89)	Q	D3	1.80	5.24	10.49	31.94	393	4,160	6,142	0
Philadelphia (7/83)	Q	D4	2.08	6.81	11.53	28.28	377	6,478	9,708	50
Pittsburgh (1/89)	Q	U	5.17	10.17	17.96	48.50	730	14,382	21,598	208
Harrisburg (1/83)	Q	U-city D5-suburb	1.28	3.66	5.94	15.56	266	4,901	7,818	107
Scranton (7/89)	Q,M	R: U C: D3	5.33	10.36	19.43	54.33	571	8,264	11,001	0
SOUTH CAROLINA										
Charleston (6/89)	M	D3	3.70	6.64	10.54	23.34	268	5,051	7,638	865
Columbia (8/89)	M	D6	2.55	4.15	8.15	24.15	387	12,610	18,472	125
Greenville (2/81)	Q	D4	2.35	3.29	6.58	18.92	193	3,117	4,613	0
TENNESSEE										
Chattanooga (3/88)	M	D5	6.59	8.35	17.14	52.32	650	7,784	11,499	0
Johnson City (7/88)	M	D8	4619	10.12	17.63	44.30	567	9,258	13,821	225
Knoxville (8/86)	M	D4	6.25	9.53	17.73	50.53	603	7,211	10,373	400

State City/ Effective Date	Bill-ing Cycle (a)	Rate Struc-ture (b)	Rates (cubic feet and thousand gallons) 5/8 meter 0 / 0	5/8 meter 500 / 3.74	5/8 meter 1,000 / 7.48	5/8 meter 3,000 / 22.44	2 inch 50,000 / 374	4 inch 1 mil / 7,480	8 inch 1.5 mil / 11,220	Connec-tion Charge (c)
TENNESSEE(cont.)										
Memphis (1/90)	M	R: D3	2.49	3.29	6.58	18.93	264	3,372	5,002	125
		D5-General Power Service								
Nashville (1/90)	M		3.83	11.00	22.95	66.84	996	15,124	22,508	250
TEXAS										
Austin (11/89)	M	U	5.46	9.39	17.84	51.65	856	16,960	25,478	1,627
Beaumont (11/89)	M	U	3.16	6.94	12.10	32.75	520	10,335	15,511	175
Corpus Christi (8/88)	M	R: I6	3.76	6.02	11.13	32.28	415	6,411	9,874	1,739
		C: D6								
Dallas (10/89)										
Summer	M	R: I3	1.29	4.92	9.62	19.89	337	6,690	10,107	225
		C: I2								
Winter	M	R: I2	1.29	4.92	9.62	18.37	290	5,719	8,650	225
		C: U								
El Paso (3/89)	M	I6	3.13	3.59	5.89	15.09	233	4,609	6,942	777
Fort Worth (10/88)										
Summer	M	D3	3.05	9.45	15.85	53.15	849	9,831	14,368	1,610
Winter	M	D3	3.05	9.45	15.85	53.15	605	9,587	14,124	1,610
Houston (8/89)	M	I2	4.47	9.78	18.34	47.68	756	14,982	22,501	135
San Antonio (12/88)	M	R: I	4.72	6.92	9.54	19.01	257	5,011	7,585	varies
		C: D								
		W: U								
UTAH										
Salt Lake (7/89)	M,B	U	6.45	6.45	6.45	15.05	239	4,383	6,722	230/ 290
VIRGINIA										
Norfolk (7/89)	B	D2	2.13	7.76	13.38	37.20	552	10,448	15,749	525
WASHINGTON										
Seattle (1/84)										
Summer	M,B	R: I2	1.40	5.74	10.58	18.39	273	5,353	8,067	0
Winter		C: U	1.40	5.40	9.39	15.21	220	4,293	6,477	0
Tacoma (1/89)	B	R: U	6.35	9.00	11.64	20.75	291	3,914	5,838	2,625
		C: D4								

State City/ Effective Date	Bill-ing Cycle (a)	Rate Struc-ture (b)	Rates (cubic feet and thousand gallons) 5/8 meter 0 / 0	500 / 3.74	1,000 / 7.48	3,000 / 22.44	2 inch 50,000 / 374	4 inch 1 mil / 7,480	8 inch 1.5 mil / 11,220	Connec-tion Charge (c)
WISCONSIN										
Milwaukee (6/88)	Q,M	D4	1.93	5.08	8.23	20.83	316	5,005	7,046	245

Source: *Ernst & Young's 1990 National Water and Wastewater Rate Survey* (Charlotte, NC: National Environmental Consulting Group, Ernst & Young, 1990).

Note: Dates in parentheses following each city name indicate when the rate structure was approved or implemented.

(a) M=Monthly
B =Bimonthly
Q=Quarterly
S =Seminannually
T =Triannually
A =Annually

(b) R =Residential
C =Commercial
W=Wholesale
U=Uniform
D=Decreasing block (with number of blocks)
I =Increasing block (with number of blocks)

(c) Total one-time charges assessed for a new single-family residence to connect to the water system.

GLOSSARY OF COST ALLOCATION AND RATE DESIGN TERMS

abandonment. Retirement of a utility plant on the books without its physical removal from its installed location. NARUC(a)

above the line. Expenses incurred in operating a utility that are charged to the ratepayer. They are written above a line drawn on the income statement separating them from costs paid by investors. See also **below the line.** NARUC(a)

absorption costing. See **full costing.**

accelerated depreciation. Depreciation methods that amortize the cost of an asset at a faster rate than under the **straight-line method.** The three principal methods of accelerated depreciation are sum of the year's digits, double declining balance, and units of production. AWWA(c)

account water. All water for which an account exists, the water is metered, and the account is billed. This concept is preferable to "accounted-for water." See also, **authorized water uses** and **non-account water.** AWWA(e)

accounts. Accounts prescribed in the NARUC(b) Uniform System of Accounts for Water Utilities. NARUC(b)

accrual basis. The basis of accounting under which revenues are recorded when earned and expenditures are recorded when they become liabilities for benefits received, notwithstanding that receipt of the revenue or payments of the expenditures may take place, in whole or in part, in another accounting period. See also **cash basis.** AWWA(c)

accrued depreciation. Monetary difference between the original cost of an article and its remaining value. NARUC(a)

acquisition adjustment. The difference between the price paid to acquire an operating unit or system of a utility and the rate base of the acquired property. See also **plant acquisition adjustment.** NARUC(a)

acquisition adjustment. The difference between the cost of acquiring an **operating unit or system** and the depreciated **original cost** of the acquired property. (Note: any existing **contributions in aid of construction** are also carried through the property transfer and reinstated by the new owner, thus affecting the amount of recorded acquisition adjustment.) See also **plant acquisition adjustment.** DHS

actually issued. As applied to securities issued or assumed by the utility, those which have been sold to bona fide purchasers for a valuable consideration, those issued as dividends on stock, and those which have been issued in accordance with contractual requirements direct to trustees of sinking funds. NARUC(b)

actually outstanding. As applied to securities issued or assumed by the utility, means those which have been actually issued and are neither retired nor held by or for the utility; provided, however, that securities held by trustees shall be considered as actually outstanding. NARUC(b)

ad valorem tax. A state or local tax based on the assessed value of the real or personal property. AWWA(b)

advance for construction. Advance made by or on behalf of customers or others for the purpose of construction, which is to be refunded either wholly or in part. When applicants are refunded the entire amount to which they are entitled according to the agreement or rule under which the advance was made, the balance, if any, remaining in this account shall be credited to **contribution in aid of construction.** AWWA(b)

allowance for funds used during construction (AFUDC). A percentage amount added to **construction work in progress (CWIP)** to compensate the utility for funds used to finance new plant under construction prior to its inclusion in rate base. NARUC(a)

amortization. The gradual extinguishment of an amount in an account by distributing such amount over a fixed period, over the life of the asset or liability to which it applies, or over the period during which it is anticipated the benefit will be realized. NARUC(b)

ancillary charge. A separate charge for ancillary services that is not included in costs for general water service. These ancillary services often must be performed by the utility and benefit only the individual customer using them and have no system-wide benefit. AWWA(b)

associated companies. Companies or persons that, directly or indirectly, through one or more intermediaries, control, are controlled by, or are under common control with, the accounting company. NARUC(b)

attributable costing. A cost accounting method in which the cost of providing any service is the costs that could be escaped over time if that service were eliminated and capacity was adjusted accordingly. The assignment of some indirect fixed overhead is required to implement this costing method and it is a longer-run concept than **direct costing.** AUT

audit. See **water audit.**

authorized water uses. All water uses known and approved or authorized by the utility. These uses include all metered uses and reliable estimates of all other approved uses such as public, fire, system, operation, and paid-for uses. AWWA(e)

automatic adjustment clause. Allows a utility to increase or decrease its rates to cover costs of specific items without a formal hearing before a commission. The utility can automatically change its rates only when the price it pays for those specified items goes up or down. Fuel adjustment clauses are an example. NARUC(a)

availability charge. A limited-use **dedicated-capacity** charge made by a water utility to a property owner between the time when water service is made available to the property and the time when the property connects to the utility's facilities and starts using the service. See also **demand-contract charge.** AWWA(b)

average-and-excess method. A method for allocating demand costs by which total demand costs are multiplied by the system's **load factor** to arrive at a cost that can be attributed to average use and allocated to each customer class in proportion to their annual consumption. The remaining costs are generally allocated to each class on the basis of the **noncoincident-demand method.** See also **base-extra capacity method** and **commodity-demand method.** AUT

average demand. The demand on, or output of, a utility system over any interval of time. NARUC(a)

average incremental cost. For a specified time period, the addition to total cost resulting from an increase in capacity divided by the incremental output provided. See also **incremental cost** and **marginal cost.** AUT

average load. The total production for the period divided by the hours in the period. DHS

average service life. Used in determining depreciation, the average expected life of all the units in a group of assets. NARUC(a)

average variable pricing. A pricing structure in which the price per unit varies according to actual expenditures during the billing period. It does not affect use and should be used only where costs vary significantly between billing periods. AWWA(d)

base costs. Costs that tend to vary with the total quantity of water used plus those operation and maintenance expenses and capital costs associated with service to customers under average load conditions, without the elements of cost incurred to meet water use variations and resulting peaks in demand. AWWA(a)

base-extra capacity method. An average-and-excess method by which costs of service are separated into four primary cost components: (1) base costs, (2) extra capacity costs, (3) customer costs, and (4) direct fire-protection costs. AWWA(a)

base load. The minimum quantity of utility product delivered over a given period of time. NARUC(a)

base rate. A fixed amount charged each month for any of the classes of utility service provided to a customer. NARUC(a)

base year. The actual or test data year on which a financial model is based. It is the first year of data entry in the model. AWWA(f)

below the line. Expenses incurred in operating a utility that are charged to the investor, not the ratepayers; that is, all income statement items of revenue and expense not included in determining net operating income. If the item falls below the net operating income line of the income statement, it is labeled a below-the-line item. Net operating income is the "line" referred to. See also **above the line.** NARUC(a) and DHS

beneficiality. A service is said to benefit from a cost if that cost is necessary to render that service. AUT

benefit-to-cost ratio. The value derived from dividing the sum of all benefits from an activity by the sum of all costs associated with that activity. A benefit-to-cost ratio having a value of 1.0 or greater would indicate that the program is economically worthwhile. AWWA(e)

bill tabulation. A method that shows the number of customer bills rendered at various levels of water usage during a specified period of time for each customer class served by the utility. The tabulation of bills for an historical period provides the basis for identifying typical customer-class usage patterns and aids in the development of rates recognizing such usage patterns. AWWA(a)

book cost. The amount at which property is recorded in these accounts without deduction of related provisions for accrued depreciation, amortization, or for other purposes. NARUC(b)

book value. The accounting value of an asset. The book value of a capital asset equals its original cost minus accumulated depreciation. The book value of a share of common stock equals the net worth of the company divided by the number of shares of stock outstanding. NARUC(a)

budget. An estimate of proposed expenditures for a given period or purpose and a statement of the means of financing them. AWWA(c)

CCF. One-hundred cubic feet.

capacity. The ability of the water utility to have the resources available to meet the water-service needs of its customers. It is the combination of plant- and service-related activities required to provide the amount of service required by the customer. The plant facilities required are a composite of all types of facilities needed to provide service. It represents the ability of the water utility to meet the quantity, quality, peak loads, and other service needs of the various customers or classes of customers served by the utility. See also **dedicated capacity** and **future capacity.** AWWA(b)

capacity (demand) costs. As used in the **commodity-demand method,** costs associated with providing facilities to meet the peak rates of use, or demands, placed on the system by the customers, including capital-related costs on plant designed to meet peak requirements plus the associated operation and maintenance expenses. This cost component may be broken down into costs associated with meeting specific demands, such as maximum-day, maximum-hour, or other periods of time that may be appropriate to the utility. AWWA(a)

capacity required. Reflects the idea that costs or capacity are assigned according to whether they are necessary to the performance of the service. The relevant test is that if these costs were not incurred, the service could not be rendered. AUT

capital intensive. A term used to designate a condition in which a relatively large dollar investment is required to produce a dollar of revenue. DHS

capital program. A plan for capital expenditures to be incurred each year over a fixed period of years to meet capital needs arising from a long-term work program or otherwise. It sets forth each project or other contemplated expenditures in which the entity is to have a part and specifies the full resources estimated to be available to finance the projected expenditures. AWWA(c)

capital structure. The permanent long-term financing of the firm represented by long-term debt, preferred stock, and net worth. NARUC(a)

capitalized costs. Costs are capitalized when they are expected to provide benefits over a period longer than one year. Capitalized costs are considered investments and are included in rate base to be recovered from customers over a number of years. NARUC(a)

cash basis. The basis of accounting under which revenues are recorded when cash is received and expenditures are recorded when cash is disbursed. See also **accrual basis.** AWWA(c)

cash basis for rates. Rates based on cash requirements for operating expenses, capital, and debt service. Most publicly owned utilities use this basis. AWWA(f)

class A utilities. Utilities having annual water operating revenues of $750,000 or more. NARUC(b)

class B utilities. Utilities having annual water operating revenues of $150,000 or more but less than $750,000. NARUC(b)

class C utilities. Utilities having annual water operating revenues of less than $150,000. NARUC(b)

coincident-demand method. A method for allocating demand costs according to the proportion of customer class demand at the time of system peak. See also **noncoincident-demand method.** AUT

coincident peak. Any demand that occurs simultaneously with any other demand on the same utility system. See also **noncoincident peak.** NARUC(a)

collection-related charges. Service fees pertaining principally to the collection and billing functions of the water utility, including delinquency (late) fees and short-check (returned check) charges. AWWA(b)

commodity (operating) costs. Costs that tend to vary with the quantity of water produced, including costs of chemicals, a large part of power costs, and other elements that increase or decrease almost directly with the amount of water supplied. AWWA(a)

commodity-demand method. A non-coincident demand method by which costs of service are separated into four primary cost components: (1) **commodity costs,** (2) **demand costs,** (3) **customer costs,** and (4) direct **fire-protection** costs. AWWA(a)

composite depreciation rate. A percentage based on the weighted average service life of a number of units of plant, each of which may have a different individual life expectancy. Composite depreciation rates may be determined for (a) a single depreciable plant account, (b) a single rate for several depreciable accounts, or (c) a single composite rate for all depreciable plant of the utility. NARUC(b)

connection charge. The charge made by the utility to recover the cost of connecting the customer's service line to the utility's facilities. This charge is often considered as contribution of capital by the customer or other agency applying for service. AWWA(b)

construction work in progress (CWIP). A subaccount in the utility plant section of the balance sheet representing the costs of utility plant under construction but not yet placed in service. NARUC(a) The utility's investment in facilities under construction but not yet dedicated to service. The inclusion of CWIP in rate base varies from one regulatory agency to another. AWWA(c)

contract demand. Relates to an agreement between the water utility and a large-use customer who requires a significant amount of the total capacity of the utility. The agreement would fix the terms and conditions under which the water utility would provide service to the customer. Such an agreement has been called contract capacity. AWWA(b)

contribution in aid of construction. Any amount of money, services, or property received by a water utility from any person or governmental agency that is provided at no cost to the utility. It represents an addition or transfer to the capital of the utility, and is utilized to offset the acquisition, improvement, or construction costs of the utility's property, facilities, or equipment used to provide utility services to the public. It includes amounts transferred from advances for construction representing any unrefunded balances of expired refund contracts or discounts resulting from termination of refund contracts. Contributions received from governmental agencies and others for relocation of water mains or other plant facilities are also included. See also **allowance for funds used during construction (AFUDC).** AWWA(b)

control. The possession, directly or indirectly, of the power to direct or cause the direction of the management and policies of a company, whether such power is exercised through one or more intermediary companies, or alone, or in conjunction with, or pursuant to an agreement, and whether such power is established through a majority or minority ownership or voting of securities, common directors, officers, or stockholders, voting trusts, holding trusts, **associated companies**, contract, or any other direct or indirect means. NARUC(b)

cost. The amount of money actually paid for property or service. When the consideration given is other than cash, the value of such considerations hall be determined on a cash basis. NARUC(b)

cost causation. Reflects the idea that costs should be assigned to the revenue-producing objects that cause those costs to be incurred. AUT

cost of capital. A utility's cost of capital is the weighted sum of the costs of component parts of the capital structure (that is, debt, preferred equity, and common equity) weighted by their respective proportions in the capital structure. AWWA(c)

cost of removal. The cost of demolishing, dismantling, tearing down, or otherwise removing utility plant, including the cost of transportation and handling incidental thereto. NARUC(b)

cost of service. The total cost of providing utility service to the system or to a group therein (the latter is commonly referred to as an allocated cost of service). The cost components include operating expenses, depreciation, taxes, and **rate of return** adequate to service investment capital. Cost of service is synonymous with the **revenue requirements** of the system (or segment thereof). DHS

cost-of-service pricing. A method of pricing service strictly in accordance with the costs (expenses and allowable profit) that are attributable to it. Customers of services priced below cost are generally subsidized by customers paying above cost for their services. NARUC(a)

curb stop. A shut-off valve attached to a water-service line from a water main to a customer's premises, which may be operated by a valvae key to start or stop flow in the water-supply lines of a building. Also called a curb cock. AWWA(b)

customer advances for construction. A deferred credit account representing cash advances paid to the utility by customers requiring the construction of facilities on their behalf. These advances are refundable; the time or extent of refund depends on revenues from the facilities. Contrast with **contributions in aid of construction (CIAC).** NARUC(a)

customer classification. The homogeneous grouping of customers into classes. Typically, water utility customers may be classified as residential, commercial, and industrial for ratemaking and other purposes. For specific utilities, there may be a breakdown of these general classes into more specific groups. For example, the industrial class may be subdivided into small industry, large industry, and special. Some water systems have individual customers (large users) with individual water-use characteristics, service requirements, or other reasons that set them apart from other general customer classes and who may require a separate class designation. This may include large hospitals, universities, military establishments, and other such categories. AWWA(b)

customer costs. Those costs associated with serving customers, irrespective of the amount or rate of water use, including meter reading, billing, and customer accounting and collecting expense, as well as maintenance and capital costs related to meters and services. AWWA(a)

cycle billing. The process of reading a segment of the system's customers each day of a billing period. By the end of the **cycle**,, the complete system is read and billed, and a new **cycle** begins. The customer reading on each day of the cycle will reflect the use for a full period so that the only customers up to date at the end of the accounting period are those read and billed as of the last day of the cycle. All other customers will have unread and unbilled consumptions of from one to thirty days, assuming a one-month cycle. This produces an **unbilled revenue** at the end of each accounting period. DHS

daily peak load pricing. A pricing structure in which the price level is higher during hours of peak use. It can be used for reducing peak use and is expensive to implement since a sophisticated meter reading system would be necessary. AWWA(d)

debt. An obligation resulting from the borrowing of money or from the purchase of goods and services. AWWA(c)

debt **expense.** All expenses in connection with the issuance and initial sale of evidences of debt, such as fees for drafting mortgages and trust deeds; fees and taxes for issuing or recording evidences of debt; cost of engraving and printing bonds and certificates of indebtedness; fees paid trustees; specified costs of obtaining governmental authority; fees for legal services; fees and commissions paid underwriters, brokers, and salesmen or marketing such evidences of debt; fees and expenses of listing on exchanges; and other like costs. NARUC(b)

debt **service.** Expenditures for interest and principal repayment on debt instruments. AWWA(f)

debt service coverage. The ratio of net revenues to **debt service** requirements. AWWA(f)

declining block pricing. See decreasing **block pricing.**

decreasing block pricing. A pricing structure, also known as declining block pricing, in which both the average and marginal price per unit decreases as consumption increases. It can be used to retain large-volume customers, who prefer this structure. When there is sufficient supply, the cost of supplying water will probably decrease as consumption increases. AUT and AWWA(d)

dedicated capacity. The portion of the water utility's total capacity that is set aside or "dedicated" for use by an individual large-use customer or group (class) of customers whose total use is a significant part of the utility's total capacity requirement. AWWA(b)

dedicated-capacity charge. A charge to ensure that the utility will recover, from those for whom a significant portion of the total utility plant facilities capacity has been dedicated, the ongoing costs associated with this capacity. Two types of dedicated capacity charges are the **availability charge** and the **demand contract-charge.** AWWA(b)

demand. The maximum rate at which a utility product is delivered to a specific point at any given moment. See also **average demand.** NARUC(a)

demand-contract charge. The use of a **dedicated-capacity charge** incorporated into a contract whereby the water customer agrees to pay the fixed costs associated with a specific share of the utility's capacity and related investment. See also **availability charge.** AWWA(b)

demand costs. See **capacity costs.**

demand factor. The ratio of the maximum demand over a specified time period to the total connected load on any defined system. NARUC(a)

demand rate. A method of pricing under which prices vary according to differences in usage or costs. NARUC(a)

depletion. The loss in service value incurred in connection with the exhaustion of the natural resource in the course of service. NARUC(a)

depreciation. As applied to depreciable utility plant, the loss in service value not restored by current maintenance, incurred in connection with the consumption or prospective retirement of utility plant in the course of providing service from causes which are known to be in current operation and against which the utility is not protected by insurance. Among the causes to be given consideration are wear and tear, decay, action of the elements, inadequacy, obsolescence, changes in the art, changes in demand, and requirements of public authorities. NARUC(b)

direct costing. A cost accounting method that assigns only those costs that vary with short-run changes in the rate of output. The costs assigned under this method are not only the direct costs but the indirect variable overhead costs as well. It is sometimes referred to as variable costing. AUT

discount. As applied to the securities issue or assumed by the utility, the excess of the par (stated value of no-par stocks) or face value of the securities plus interest or dividends accrued at the date of the sale over the cash value of the consideration received from their sale. NARUC(b)

discounted cash-flow (DCF) model. The DCF model is often used in ratemaking for estimating the investor required rate of return on common equity. By definition, the DCF model contends that the market price of a common stock is equal to the cumulative present value of all future cash flows to investors produced by said common stock. AWWA(c)

district (or zone) measurement. A measurement of all water flow into an isolated portion (district or zone) of a distribution system to be used to determine the leakage potential for the isolated zone. Annual district measurements can be compared and used to determine changes in the level of water consumption and leakage potential. AWWA(e)

diversity factor. The sum of noncoincident demands of a group divided by the group coincident demand. See also **load factor** and **utilization** factor. DHS

economies of scale. Exist when the unit or average cost of general water service decreases with the expansion of water system capacity. Economies of scale (or size) can be defined either in the context of changes in total system capacity or changes in a single component of the water system (such as treatment). See also **economies of scope.** AUT

economies of scope. Exist when the average cost of combined general water service and fire protection service is less than the cost of providing each service separately; that is, the unit cost of providing multiple services is less than if they were provided by separate utilities. See also **economies of scale.** AUT

embedded costs. Money already spent for investment in plant and in operating expenses. NARUC(a) Those costs that are in existence at any point in time regardless of the date originally incurred and that affect current operations on a continuing basis. DHS

equity. The net worth of a business, consisting of capital stock, capital (or paid in) surplus, earned surplus (or retained earnings), and, occasionally, certain net worth reserves. AWWA(c)

equivalent customer. The means of relating large-use customers to a single family unit or other small-use customer unit, such as a 5/8-inch meter customer. It would represent a composite of all elements of cost differences between the unitary customers and the large-use customers to be served. Normally, it is expressed as a ratio of the small-use customer unit. AWWA(b)

equivalent meters. The number of 5/8-inch meters equivalent in flow to a larger meter. Used to calculate monthly service charges. AWWA(f)

estimated water quantity. The quantity derived from the process of making reliable and pertinent calculations of water volumes using an appropriate method or formula to draw reasonable conclusions about an actual quantity of water. The reliability of the estimate is enhanced whenever actual times of flow, rates of flow, or partial flow volumes are measured and recorded. AWWA(e)

excess-use pricing. A pricing structure in which the price level is significantly higher for all water used above average, usually determined by winter use. It can be used to reduce peak use, and large volume users consider its use equitable. AWWA(d)

expenditures. Amounts paid or incurred for all purposes, including expenses, provisions for retirement of debt, and capital outlays. AWWA(c)

extra capacity costs. As used in the **base-extra capacity** method, those costs associated with meeting rate of use requirements in excess of average, including operation and maintenance expenses and capital costs for system capacity beyond those required for average rate of use. These costs may be subdivided into costs necessary to meet maximum-day extra demand, maximum-hour extra demand, or other extra-demand criteria appropriate to the utility. AWWA(a)

fair market value. Generally the term applies to the amount that a willing buyer will pay a willing seller in an arm's-length transaction. Because of the predominant use of **original cost** in the **rate base** and the constraints that original-cost factors place on the rates that may be charged, the depreciated book cost of utility plant may be a prominent factor in establishing fair market value for a utility system. DHS

fair value. A term normally used in those jurisdictions that, by statute or regulatory precedent, allow the **rate base** to be expressed at a level other than the recorded **original cost** amounts. The most common measure of fair value is reflected in a composite of original cost and **trended original cost** factors. In practice the fair value has often been closer to the original cost level than the trended original cost level. DHS

field-service charges. Charges related to activities including water turn on (or turn off), meter setting or removal, special meter readings, meter testing, and temporary hydrant meter settings. AWWA(b)

fire main. Any main forming part of an integrated system used exclusively for fire protection purposes. NARUC(b)

fire-protection charges. Charges made to recover the cost of providing both public and private fire-protection service to the communities served by the utility. AWWA(b)

fixed charges. Periodic charges to customers that do not vary with water use, unlike **variable charges.** AUT

fixed costs. Business costs that remain unchanged regardless of quantity of output or traffic. See also **variable costs.** NARUC(a)

fixture rate. A pricing structure in which prices for a given time period are set for each water using fixture (that is, faucets, toilets, etc.) at the location where service is provided. Although very imprecise, it is more usage oriented than a **flat fee.** AUT

flat fee. A periodic fixed charge for water service that is unrelated to the amount of water consumed, typically used when customers are unmetered. It is not the same as a **uniform rate** (which is sometimes known as a flat commodity rate). AUT

flat rate. See **flat fee.**

forecast test year. See **future test year.**

fully distributed costing. A cost accounting method in which each job or service absorbs a share of each of the costs of rendering service. It requires the allocation of indirect fixed overhead costs in their entirety, which in turn requires the calculation of predetermined overhead rates. The method uses five cost assignment criteria: (1) **cost causation,** (2) **traceability,** (3) **variability,** (4) **capacity required,** and (5) **beneficiality.** Also known as full costing, fully allocated costing, and absorption costing. AUT

functional-cost method. A method by which **costs of service** are separated into four functions which describe the activities of a water utility: (1) production and transmission, (2) distribution, (3) **customer costs,** and (4) hydrants and connections. This method has not had wide acceptance in recent years because it requires much judgment and fails to recognize that major portions of costs are capacity or demand related. AWWA(a)

future capacity. The capacity for services somewhat in excess of immediate requirements that is built into a utility in anticipation of increased demands for service resulting from higher uses by existing customers or from growth in the service area. AWWA(b)

future test year. Use of future 12-month-period projected utility financial data to evaluate a proposed tariff revision. See also **historic test year** and **test year.** Also known as a forecast test year. NARUC(a)

historic cost. The initial cost to the person who holds the property. **Original cost** and historic cost are the same where property has not changed ownership. When utility property of an **operating unit or system** nature changes ownership, the original cost carries forward and is maintained by the new owner, although the purchase price (that is, historic cost to the new owner) may be something different. DHS

historic test year. Use of a past 12-month period (usually the immediately preceding period) utility financial data to evaluate a proposed tariff revision. See also **future test year** and **test year.** NARUC(a)

hook-up fees. A charge at the time of connection. It can be used to discourage new connections and is usually used to recover connection costs, or, if a system is nearing capacity, to discourage new hook-ups. AWWA(d)

imminence. A test to determine how soon a capital asset will be put into actual use in providing utility service; that is, how soon it will be **used and useful.** NARUC(a)

increasing block pricing. A pricing structure, also known as inverted block pricing, in which the average and marginal price per block of use increases as consumption increases. It can be used for reducing average (and sometimes peak) use, and large volume users consider its use inequitable. AWWA(d)

incremental cost. The change in total cost resulting from a change in capacity, output, or services provided. See also **average incremental cost** and **marginal cost.** AUT

incremental-cost-pricing method (for determining **system-development** charges). A method in which new customers would be responsible for their share of the cost of the last increment of defined **system-development charge facilities** and/or the increment of planned future additions to meet their needs. See also **system buy-in method.** AWWA(b)

interruptible service. Service with special rates for customers who are willing to have their utility service interrupted by the utility when necessary. This is a low-priority service with generally lower unit rates. NARUC(a)

inverted block pricing. See **increasing block pricing.**

investment advances. Advances, represented by notes or by book accounts only, with respect to which it is mutually agreed or intended between the creditor and debtor that they shall be settled by the issuance of securities or shall not be subject to current settlement. NARUC(b)

leakage. See **system leakage, unavoidable leakage,** and **recoverable leakage.**

life expectancy. The time period during which an article is expected to render efficient service. See also **remaining** life. NARUC(a)

lifeline pricing. A pricing structure in which the price for "necessary" use is kept low. It can be used to reduce average use and is usually used to ensure that low-income users are not unduly burdened by high prices. AWWA(d)

load. The amount of utility product delivered at any specified point or points on a system. NARUC(a)

load factor. The ratio of average demand to peak demand, defined with reference to a specific time period or type of peak load, such as maximum-hour or maximum-day. The load factor is operationalized as the ratio of actual consumption over a period, to the maximum (peak) demand multiplied by the length of a period (the period can be hourly, daily, monthly or annual). See also **diversity factor** and **utilization factor.** AUT

load management. Techniques designed to reduce **demand** at peak times. NARUC(a)

losses. See **system water losses** and **meter losses.**

maintenance expenses. Part of **operating expenses,** including labor, materials, and other expenses, incurred for preserving the operating efficiency and/or physical condition of **utility plant.** NARUC(a)

marginal cost. The change in total cost resulting from producing (or not producing) a single incremental unit of a product or service. It is composed of: (1) the change in operating costs caused by changing the rate of utilization of existing capacity, and (2) the cost of expanding capacity, including the operating costs associated with increased capacity. See also **average incremental cost** and **incremental cost.** AUT

master metering. The use of one bulk meter for multiple tenants. NARUC(a)

meter error. That percent of water passing through the meters of a distribution system which is not properly measured by the meter. Master meter error is the meter error for all unmeasured water passing through these source or master meters, and customer meter error is all unmeasured water passing through customer meters. These errors are discovered when meters are calibrated and the quantity of error is derived from the mathematical adjustment of recorded flows to the calibrated corrections. AWWA(e)

meter losses. Water from the total of all losses resulting from meter inaccuracies. Where meters are repaired and recalibrated, meter losses can be calculated from a ratio of meter rates before and after calibration. For meters that are stopped, meter losses can be estimated from previous records from that meter during similar times and seasons. AWWA(e)

metered ratio. The ratio of all corrected water use, whether sold or not, to corrected metered water production. AWWA(e)

metered service. Meters record actual use in order to accurately bill a utility customer. See also **unmetered service.** NARUC(a)

MGD. Million gallons per day.

minor items of property. The associated parts or items of which retirement units are composed. NARUC(b)

mixed test year. A combination of the **historic test year** and **future test year** approaches also know as a partial future test year. See also **test year.** AUT

multiple family dwelling. A residential structure or group of structures which is capable of separately housing more than one family unit. NARUC(b)

net operating income. The amount of revenues from utility operations that remains after the deduction of the operating and maintenance expenses, depreciation expenses, and taxes (income, property, etc.) attributable to the utility operation. The revenues and expenses that are measured to produce net operating revenue are commonly referred to as "above-the-line" items. The revenues and expenses measured apart from net operating income are referred to as "below-the-line" items. The net operating income line on the income statement is the dividing point. See also **below the line.** DHS

net original cost. Original cost less accumulated depreciation. DHS

net salvage value. The value of property retired less the cost of removal. NARUC(b)

nominally issued. As applied to securities issued or assumed by the utility, those which have been signed, certified, or otherwise executed, and placed with the proper officer for sale and delivery, or pledged, or otherwise place in some special fund of the utility, but which have not been sold, or issued direct to trustees of sinking funds in accordance with contractual requirements. NARUC(b)

nominally outstanding. As applied to securities issued or assumed by the utility, those which, after being actually issued, have been reacquired by or for the utility under circumstances which require them to be considered as held alive and not retired; provided, however, that securities held by trustees shall be considered as actually outstanding. NARUC(b)

nonaccount water. The sum of all water produced or purchased by a water utility that is not covered by **account water.** The term is preferable to unaccounted-for water. AWWA(e)

noncoincident-demand method. A method for allocating demand costs to each customer class on the basis of its own peak, regardless of whether it occurs at system peak demand. AUT

noncoincident peak. The sum of peak demands for all customer classes. This peak may or may not coincide with the peak for the total system. AUT

nonfirm service. See **interruptible service.**

nonoperating items. Although sometimes used interchangeably with **nonutility items,** this term may more properly be used to describe items such as construction work in progress which is not currently used in providing utility service. It has also been applied traditionally to financial items (for example, interest expense). DHS

nonutility items. All items of revenue, expense, and investment not associated, either by direct assignment or by allocation, with providing service to the utility customer. DHS

off-peak. A period of relatively low system demands. See also **on-peak.** NARUC(a)

off-peak rates. The use of separate rates or rates lower than average for water delivered during off-peak periods. AWWA(a)

on-peak. A period of relatively high system demands. See also **off-peak.** NARUC(a)

operating expenses. Expenses related to maintaining day-to-day utility functions, including operation and maintenance expenses, taxes and depreciation and amortization costs, but not interest payments or dividends. Operating costs are recovered from customers on a current basis, as opposed to capitalized costs. NARUC(a)

operating ratio. The ratio, generally expressed as a percentage, of operating expenses to operating revenues. NARUC(a)

operating revenues. Amounts collected by the utility for services rendered. NARUC(a)

operating unit or system. Although not clearly defined by the Uniform System of Accounts, this term generally relates to a complete and self-sustaining facility or to a group of facilities acquired and operated intact as a segment of a complete system. DHS

original cost. As applied to utility plant, the cost of such property to the person first devoting it to public service. NARUC(b)

outage. The period during which a generating unit, transmission line, or other facility is out of service. NARUC(a)

peak demand. The maximum level of operating requirements (that is, production) placed upon the system by customer usage during a specified period of time (instantaneous peak, thirty-minute peak, one-hour peak and one-day peak outputs are common points of reference). It may be measured by an operating segment of the company, such as a customer class, or for the entire company, depending on intended use of the data. See also **off-peak** and **on-peak.** DHS

peaking factors. A measure of the additional system capacity needed to deliver peak water volumes. The ratio of peak consumption to average consumption. AWWA(f)

peak-load pricing. A pricing structure in which charges are based on both the quantity of water used and the maximum rate at which it is used. It also recognizes two types of demand (customer's demand that is coincidental with the system peak demand and customer's non-coincidental demands) and prices each separately. AWWA(a)

peak responsibility method. A **cost of service** method proposed for application to telephone utilities that allocates costs according to how and when service is used and how this use contributes to congestion on plant and equipment required to provide service. AUT

plant acquisition adjustment. The difference between the cost to the utility of acquired plant and the original cost of the plant less the amount credited at the time of acquisition for depreciation and amortization and **contributions in aid of construction.** See also **acquisitions adjustment.** NARUC(a)

plant held for future use. Cost of land or other property acquired by a utility but not yet used for generation, transmission, or distribution purposes. See also **utility plant in service.** NARUC(a)

plant in service. See **utility plant in service.**

premium. As applied to the securities issued or assumed by the utility, the excess of the cash value of the consideration received from their sale over the sum of their par (stated value of no-par stocks) or face value and interest or dividends accrued at the date of sale. NARUC(b)

property retired. As applied to utility plant, property which has been removed, sold, abandoned, destroyed, or which for any cause has been permanently withdrawn from service. NARUC(b)

prudence. A consideration of whether investments are dishonest or obviously wasteful. NARUC(a)

rate base. The value of a water utility's property used in computing an authorized return under the applicable laws and/or regulatory policies of the agency setting rates for the utility. AWWA(b)

rate base regulation. A method of regulation in which a public utility is limited in operations to revenue at a level which will recover no more than its expenses plus an allowed **rate of return** on its **rate base.** NARUC(a)

rate of return. The *realized* rate of return is the percentage factor obtained by dividing the **net operating income** from utility operations by the **rate base.** An *adequate* rate of return is the percentage factor that, when multiplied by the rate base, produces earnings that will meet the interest and equity requirements of the capital used to support the rate base. The measure of the adequacy of the rate-of-return factor is usually based upon cost-of-capital measurements. DHS

rate structure. The design and organization of billing charges by customer class to distribute the **revenue requirement** among customer classes and rating periods. NARUC(a)

recoverable leakage. All water from breaks and leaks that are repaired or are considered to be economical to repair. AWWA(e)

reimbursement costing. A cost accounting method used to develop cost-based prices that recover the total cost of production. It employs concepts governing the measurement of costs that are negotiated by customers or their representatives. AUT

remaining life. The expected future service life of an asset at any given age. See also **life expectancy.** NARUC(a)

replacement (or replacing). The construction or installation of utility plant in place of property retired, together with the removal of the property retired. NARUC(b)

replacement cost. An estimate of the cost to replace the existing facilities (either as currently structured or as redesigned to embrace new technology) with facilities that will perform the same functions. This method recognizes the benefits of presently available technology in replacing the system. For example, a number of small generating units may be replaced with a single large unit at lower unit costs and greater efficiency. DHS

reproduction cost. The estimated cost to reproduce existing properties in their current form and capability at current cost levels. The mechanics may involve a trending the original cost dollars to reflect current costs or conducting a property appraisal with cost estimates to for reconstructing the facilities. DHS

research and development. Expenditures incurred by public utilities which represent research and development costs in the experimental or laboratory sense. The term includes generally all such costs incident to the development of an experimental or pilot model, a plant process, a product, a formula, an invention, or similar property, and the improvement of already existing property of the type mentioned. NARUC(b)

retained earnings. The accumulated net income of the utility less distributions to stockholders and transfers to other capital accounts, and other adjustments. NARUC(b)

retirement units. Those items of utility plant which, when retired, with or without replacement, are accounted for by crediting the original cost.

revenue requirements. The amount of return (rate base times rate of return) plus operating expenses. NARUC(a) The sum total of the revenues required to pay all operating and capital costs of providing service. DHS

salvage value. The amount received for property retired, less any expenses incurred in connection with the sale or in preparing the property for sale, or, if retained, the amount at which the material recoverable is chargeable to materials and supplies, or other appropriate account. NARUC(b)

scarcity pricing. A pricing structure in which the cost of developing new supplies is attached to existing use. It can be used to reduce average use and where supplies are diminishing (that is, a finite supply) so that costs for developing new supplies are paid for by current users. AWWA(d)

seasonal pricing. A pricing structure in which the price level during the season of peak use (summer) is higher that the level during the winter. It can be used to reduce peak use, and large volume users consider its use equitable. It can be effective for summer tourist communities. AWWA(d)

service connection. That portion of the service line from the utility's water main to and including the curb stop at or adjacent to the street line or the customer's property line. It includes other valves, fittings, and so on, that the utility may require at or between the main and the curb stop, but does not include the curb box. AWWA(b)

service life. The time between the date utility plant can be included **in utility plant in service,** or utility plant leased to others, and the date of its retirement. If depreciation is accounted for on a production basis rather than on a time basis, then service life should be measured in terms of the appropriate unit of production. NARUC(b)

service line. The pipe and all appurtenances that run between the utility's water main and the customer's place of use and includes fire lines. AWWA(b)

service value. The difference between the original cost and the net **salvage value** of utility plant. NARUC(b)

sliding scale pricing. A pricing structure in which the price level per unit for all water used increases based on average daily consumption. It can be used for reducing average (and sometimes peak) use and large volume users consider its use inequitable. AWWA(d)

spatial pricing. A pricing structure, also known as zonal pricing, in which users pay for the actual costs of supplying water to their establishment. Costs (and hence prices) will tend to vary regionally within the service sector. Spatial pricing can be used to discourage new or difficult to serve connections and is used in areas where the distribution system is being expanded rapidly and being expanded in difficult to serve areas (long mains, pumps, and so on). AWWA(d)

straight-line method. As applied to **depreciation** accounting, the plan under which the service value of property is charged to operating expenses (and to clearing accounts if used), and credited to the accumulated depreciation account through equal annual charges during its service life. Estimates of the service life and salvage will be reexamined periodically and depreciation rates will be corrected to reflect any changes in these estimates. NARUC(b)

straight-line remaining life method. As applied to **depreciation** accounting, the plan under which the service value of property is charged to operating expenses (and to clearing accounts if used), and credited to the accumulated depreciation account through equal annual charges during its service life. "Remaining life" implies that estimates of future life and **salvage** will be reexamined periodically and that depreciation rates will be corrected to reflect any changes in these estimates. NARUC(b)

supply main. Any main, pipe, aqueduct or canal, the primary purpose of which is to convey water from one unit to another unit in the source of supply, water treatment or pumping plant and generally providing no service connections with customers. See also **transmission and distribution main.** NARUC(b)

system buy-in method. A method of determining a **system-development** charge from new customers (or developers who represent them) based on the premise that new customers are entitled to water service at the same prices charged to existing customers. The fee to new customers is related to the embedded average-equity investment in the reserve capacity or new capacity used to serve them. See also **incremental-cost pricing method.** AWWA(b)

system-capacity charge. See **system-development** charge.

system-development charge. A contribution of capital toward recently completed or planned future backup plant facilities necessary to meet the service needs of new customers to which such fees apply. Two methods used to determine the amount of these changes are the **system buy-in method** and **incremental-cost pricing method.** Various terms have been used to describe these charges in the industry, but regardless of the term used, these charges have the purpose of providing funds to be used to finance all or part of capital improvements necessary to serve new customers and are raised outside of capital to be served from general water-use rates. Also known as a system-capacity charge. AWWA(b)

system-development charge facilities. Those facilities, or a portion of those facilities, that have been identified as being required for new customer growth. The cost of the facilities will be recovered in total or in part through a **system-development charge.** AWWA(b)

system leakage. All water that is lost from the system through leaks and breaks and includes all **unavoidable leaks,** and all **recoverable leaks** and breaks. AWWA(e)

system water losses. Water from all losses such as theft, illegal connections, unauthorized uses, malfunctioning controls, differences in use quantities caused by meter error and any other loss which is not a result of a leak or a break. AWWA(e)

tariff. The authorized list of charges for a utility's services. AUT

tax incentives. Tax credits or reductions provided to water users who have installed conservation devices. They can be used to reduce either peak or average use and allow for voluntary user choice to use conservation devices. AWWA(d)

test year. The annualized period for which costs are to be analyzed and rates established. AWWA(c) The twelve-month operating period selected to evaluate the **cost of service** and the adequacy of rates in effect or being sought. Frequently, the term "test period" is used, and may refer simply to the test year or expressly to the *adjusted* test year. See also, **historic test year, future test year,** and **mixed test year.** DHS

traceability. An attribute of costs that permits the resources represented by the costs to be identified in their entirety with a revenue-producing unit. AUT

transmission and distribution main. Any main the primary purpose of which is to convey water, requiring no further processing except incidental chlorination or pressure boosting, from a unit in the source of supply, water treatment of pumping plant and generally providing no service connections with customers. See also **supply main.** NARUC(b)

trended original cost. The result of isolating original-cost plant additions by year of placement and factoring the original amounts upward to recognize subsequent changes in the cost of constructing plant facilities. The object is usually to restate installed cost of facilities at current levels. DHS

unaccounted-for water. See **nonaccount water.**

unavoidable leakage. All water from underground leaks which, due to the small amount of actual water lost, would cost more to locate and repair than the value of the water saved over a reasonable amount of time. See also **recoverable leakage** and **system leakage.** AWWA(e)

unbilled revenues. The amount of service rendered but not recorded or billed at the end of an accounting period. Cycle meter reading practices result in unrecorded consumption between the date of last meter reading and the end of the period. If these amounts are not estimated and recorded, they reflect "unbilled" amounts. DHS

uniform rate. A pricing structure in which the price per unit is constant as consumption increases. It may be somewhat effective in reducing average use, and large volume users consider its use equitable. It is also know as a flat rate or a uniform block rate, but is not the same as a **flat fee.** AWWA(d)

uniform system of accounts (USOA). A list of accounts for the purpose of classifying all plant and expenses associated with a utility's operations. The USOA specifies a number for each account, together with a title and a description of content, and prescribes the rules and regulations governing the use of such accounts. Systems of accounts may be prescribed by federal and/or state regulatory authorities. NARUC(a)

unit cost. The cost of producing a unit of a produce or service. An example would be the cost of treating a thousand gallons potable water for use by the water utility's customers. AWWA(b)

unmetered service. Utility service used and billed without being recorded by a meter. See also **metered service.** NARUC(a)

used and useful. A test for determining the admissibility of utility plant as a component of rate base. Plant must be in use (not under construction or standing idle awaiting abandonment) and useful (actively helping the utility provide efficient service). See also **imminence.** NARUC(a)

user charges. The monthly, bimonthly, quarterly, or other periodic charges made to the users of water service through the general water-rate structures of the water utility. AWWA(b)

user fees. Amounts paid by consumers of a service that cover all or part of the cost of providing the service. In contrast, some governmental services are paid for or subsidized by taxes. AUT

utility plant in service. The land, facilities, and equipment used to generate transmit, and/or distribute utility service. See also **plant held for future use** and **used and useful.** NARUC(a)

utility water use. That water which is removed from the distribution system by the utility for the purpose of maintaining and operating the system. This should include both metered and unmetered water removed with those unmetered use being reliably estimated. AWWA(e)

utilization factor. The ratio of the maximum demand of a system to the installed capacity of the system. See also **diversity factor** and **load factor.** DHS

value of service. A concept in utility pricing practice whereby the usefulness o necessity of the service to a customer group replaces cost factors as a major influence on the rates charged to the group. DHS

variable charges. Periodic charges to customers that vary with water use, unlike **fixed charges.** AUT

variable costs. Costs which change with the increase or decrease of output. See also **fixed costs.** NARUC(a)

variability. An attribute of costs not traceable to a revenue-producing object based on whether it varies in total with variations in some measure of the volume of activity that is associated with the revenue-producing object. These costs can be assigned to revenue-producing objects according to an estimated rate of variability. AUT

vertical service. The utility company performs all major utility services for its customers, including production, transformation, transmittal, and distribution. This is typical of water utilities. NARUC(a)

vintage rates. A program in which customers are classified and customer rates are based on the date or period in which a customer connects to and first obtains service from the utility system. Such rates and charges can include user rates; customer contributions of capital for system development, main extension, and connection fees; or for ancillary services rendered. The concept has been used during periods of rising average costs to reflect the higher costs associated with serving new customers. AWWA(b)

water audit. A thorough accounting of all water into and out of a utility as well as an in-depth record and field examination of the distribution system that carries the water, with the intent to determine the operational efficiency of the system and identify sources of water loss and revenue loss. AWWA(e)

wheeling charge. The charge made by a utility for transmission of water to another party through its system. AWWA(c)

wholesale service. A situation in which water is sold to a customer at one or more major points of delivery for resale to individual retail customers within the wholesale customer's service area. AWWA(a)

working capital. Used broadly, the term refers to those rate-base allowances other than the utility plant in service and may include material, fuels, supplies, and so on. In the narrower use, commonly referred to as cash working capital, it relates to the investor-supplied funds necessary to meet operating expense or going-concern requirements of the business. There is normally a time lag between the point when service is rendered and the related operating costs are incurred and the point when revenues to recover such costs are received. The operating funds to bridge the lag are usually supplied by the investor and become a fixed commitment to the enterprise. DHS

zonal pricing. See spatial pricing.

zone measurement. See district measurement.

The **Glossary** was adapted from the following sources:

AUT Authors.

AWWA(a) American Water Works Association, *Water Rates* (Denver CO: American Water Works Association, Manual M1, 1983).

AWWA(b) American Water Works Association, *Water Rates and Related Charges* (Denver, CO: American Water Works Association, Manual M26, 1986).

AWWA(c) American Water Works Association, *Revenue Requirements* (Denver, CO: American Water Works Association, Manual M35, 1990).

AWWA(d) American Water Works Association, *Before the Well Runs Dry, Volume 1* (Denver, CO: American Water Works Association, 1984).

AWWA(e) Lynn P. Wallace, *Water and Revenue Losses: Unacccounted for Water* (Denver, CO: American Water Works Association, 1987).

AWWA(f) Jack A. Weber and David S. Hasson, *Reference Manual: A Financial Planning Model for Small Water Utilities* (Denver, CO: American Water Works Association, 1990).

DHS Deloitte Haskins & Sells, *Public Utilities Manual* (USA: Deloitte Haskins & Sells, 1984).

NARUC(a) National Association of Regulatory Utility Commissioners, *NARUC Annual Report on Utility and Carrier Regulation 1988* (Washington, DC: National Association of Regulatory Utility Commissioners, 1989).

NARUC(b) National Association of Regulatory Utility Commissioners, *Uniform System of Accounts for Class A Water Utilities 1984* (Washington, DC: National Association of Regulatory Utility Commissioners, 1984).

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VIABILITY POLICIES AND ASSESSMENT METHODS FOR SMALL WATER UTILITIES

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EXECUTIVE SUMMARY

The proliferation of nonviable small water systems may not be the most prominent issue on the regulatory agenda at large, but it probably is the most pressing issue with respect to the regulation of water utilities. Public policies in this area can be distinguished in terms of whether they target proliferation (the birth of systems) or viability (the survival of systems), although many policies actually address both problems at once.

Based on the empirical evidence, proliferation (that is, *growth* in the number of systems) may not be as pervasive a problem today as might be assumed. The decline in the investor-owned water utility population can partly be attributed to economic factors, but the role of state policy in contributing to this trend may be equally relevant. Still, controlling the emergence of water systems is perhaps the most essential of all viability policies; without nonproliferation policies the task of improving viability is made much harder.

In developing a framework for this analysis, key dimensions of water utility viability were identified. Three are performance dimensions (technical, financial, and managerial) and three are institutional dimensions (regulatory, structural, and comprehensive). This framework is used in the discussion of the industry's performance, the review of viability policies for emerging and existing water systems, and the presentation of viability assessment methods.

The key to assuring the viability of water systems is the judicious use of state regulatory authority so that only viable systems emerge in the first place. This authority rests in the hands of state drinking water regulators and, in the case of many small systems, state public utility commissions. Each has a certification process, a permitting process, or both whereby new systems emerge. The need to tighten up the certification and permitting processes and curtail the emergence of new nonviable water systems has been well recognized by the states. Many have taken significant steps in this area and have begun to see positive results in slowing the proliferation of new water systems.

Past proliferation and financial distress caused by a variety of factors have resulted in the existence and persistence of thousands of small water systems whose viability is precarious. For failing water systems, institutional solutions are virtually imperative. While the primary issue for emerging water systems is a regulatory one (namely certification), for existing systems issues of structure are especially important, reflecting a strong interest in improving the industry's efficiency and, hence, viability.

In light of the growing interest in viability policies for both emerging and existing water systems, the need for performance assessment techniques also has grown. Water utilities, their regulators, and others concerned about viability can apply a variety of rudimentary assessment techniques to evaluate or "screen" water utilities. Utilities themselves may use these techniques to appraise their own condition or that of another utility with which they might want to do business. Regulators may use the same techniques to evaluate certificate applications, survey the health of existing utilities, or to trigger intervention. Public policy analysts may use them to measure the effectiveness of water utility viability policies.

Effective viability policies require assessment methods that can be used by regulators and others for screening utilities and triggering intervention as needed. Because financial performance is so vital to water system viability, a need exists for methods specifically designed to assess the financial health of existing water systems and the expected health of emerging water systems. Some basic assessment methods are introduced as well as a financial distress classification model.

This research endeavor has shown that performance assessment methods can play a role in developing viability policies for water utilities. Despite limitations, performance assessment is critical even before a water system is operational. Certification of water systems should be rigorous, thorough, and restrictive when necessary. Barriers to market entry are necessary whenever a local economy cannot support the full cost of water service from a new water system. Existing systems, too, should be screened along various performance criteria. As a diagnostic tool, performance assessment can assist regulators in identifying cases where intervention is justified. Another application for existing systems is the use of performance assessment in evaluating prospective structural changes, such as mergers, acquisitions, and satellite management.

Signs of change for the water industry, especially its small systems component, can be seen. In many ways, this study has attempted to hit a moving target, as some significant water system viability policies have been adopted as recently as early 1992. The states clearly have found ways to address the serious problems of small water systems. Continued experimentation in this area is needed along with monitoring to assess the effectiveness of various policy alternatives in meeting the goals of performance, efficiency, and viability.

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FOREWORD

The viability of emerging and existing small water utilities is an area of ongoing concern to state public utility commissions as well as state drinking water program administrators. This report addresses public policies targeting the viability issue.

Douglas N. Jones
Director
Columbus, Ohio
June 15, 1992

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CHAPTER 1

PROLIFERATION AND VIABILITY OF SMALL WATER SYSTEMS

The proliferation of nonviable small water systems may not be the most prominent issue on the regulatory agenda at large, but it probably is the most pressing issue with respect to the regulation of water utilities. This is an issue not only for public utility regulators whose chief concern is economic regulation, but a significant one for drinking water administrators whose focus is on public health, as well as water planners whose focus is on resource management and protection. Public policies in this area can be distinguished in terms of whether they target proliferation (the birth of systems) or viability (the survival of systems), although many policies actually address both problems at once.

This study is the most recent of several by NRRI addressing small water systems and their regulation by state public utility commissions.[1] Based on this research, as illustrated in table 1-1, both the problems of small water systems and appropriate solutions are entwined with the phases of the regulatory process. More attention than ever is being paid to small water system viability in light of the Safe Drinking Water Act (SDWA) as amended in 1986. The economic and regulatory impact of the SDWA has even raised the possibility of a small system crisis:

> It is a fact that problems frequently do not get solved in our society until they reach crisis proportions. The small water system situation is a dilemma, but it is not yet a crisis. It will become a crisis once state drinking water programs accept primary enforcement responsibility for the waves of comprehensive regulations currently under development by the USEPA. . . . Once the states begin implementation of the provisions of the new law, the enforcement pressures on small systems will increase steadily and inexorably.[2]

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[1] A listing of NRRI reports on water utilities and their regulation appears at the end of the bibliography of this report.

[2] G. Wade Miller, John E. Cromwell III, and Frederick A. Marrocco, "The Role f the States in Solving the Small System Dilemma," *Journal of the American Water 'orks Association* (August 1988): 37.

TABLE 1-1
PROBLEMS AND SOLUTIONS IN SMALL WATER SYSTEM REGULATION

Stage	Problems	Solutions
I.	**Demand for Creation of Small Water Utilities**	
	· Reliance on small water supply · Distance from large water supply systems · Adjuncts of land development	· Certificates of convenience and necessity · Regionalization · Land-use controls
II.	**Establishment of Small Water Utilities**	
	· Little capital · Weak management experience and structure	· Cooperative ownership · Capital subsidies · Education and training · Setting initial rates
III.	**Utility Operations**	
	· Low revenues · Poor recordkeeping · Inadequate service quality · Deteriorating plant · Low capital reserves	· Consolidation · Centralized assistance · In-service education and training · Annual reports · Receivership
IV.	**Application for Rate Relief**	
	· Unfamiliar procedures · Disproportionately expensive to utility · Poor quality submission to commission	· Case consolidation · Routinized timing · Deregulation · Safe harbors · Automatic adjustments
V.	**Processing Application for Rate Relief**	
	· Expensive for company · Time consuming for commission	· Stipulated proceedings · Short forms · Complaint-triggered rate case · Staff-assisted rate case

Source: Adapted from Raymond W. Lawton and Vivian Witkind Davis, *Commission Regulation of Small Water Utilities: Some Issues and Solutions* (Columbus, OH: The National Regulatory Research Institute, 1983), 4 and 67.

Federal regulators have recognized this effect and have devoted considerable attention to the problems of small water systems in the past few years. Studies by the U.S. Environmental Protection Agency (EPA) provide evidence of the strong interest in these issues at the federal level: *Establishing Programs to Resolve Small Drinking Water System Viability: A Summary of the Federal/State Workshop* (February 1991); *Improving the Viability of Existing Small Drinking Water Systems* (June 1990); and *Ensuring the Viability of New, Small Drinking Water Systems: A Study of State Programs* (April 1989).

The EPA also conducts workshops, publishes occasional bulletins and newsletters focused on viability, and has developed a program for mobilizing resources aimed at SDWA compliance. The three principal components of mobilization are strengthening the institutional framework for water supply at the state and utility levels, improving water systems' technical and managerial capabilities, and building public support for safe drinking water.[3]

Because most forms of water management and regulation are implemented at the state level, the states have long been sensitized to the problems of small water systems. The importance of the states relative to both the federal and local governments is well recognized.[4] With the mounting constraints on viability, state regulators may find the regulation of small water systems even more troublesome than in the recent past.[5] In response, several states have conducted their own studies and investigations of small water systems and their regulation. As revealed in a recent analysis of jurisdictional water utilities by staff of the Public Utilities Commission of Ohio, commissions are well aware not only of the precarious condition of small systems but the reasons for it as well:

> [O]ften times the smaller companies fail to ask the Commission for sufficient rate increases or do not ask at all because of the time and complexity, either real or perceived, involved in a rate case filing; the small plants may be older, less efficient, and insufficiently maintained;

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3 "EPA Program to 'Mobilize' Compliance Efforts," *Mainstream* (A publication of the American Water Works Association), 34 no. 8 (August 1990), 9.

4 Daniel A. Okun, "State Initiatives for Regionalization," *American Water Works Association Journal* 73 (May 1981): 243-45.

5 G. Richard Dreese, "The Bleak Future of Small Investor-Owned Water Companies and Their Customers: Ohio as a Case Study," *Ohio Cities and Villages* 36 no. 1 (February 1988): 15.

> management may not be skilled in properly running a water and sewer utility; and the smaller customer base means economies of scale are not at the same level as the larger companies. Also, it cannot be overlooked that the accuracy of the bookkeeping of smaller companies is often in question due to poor recordkeeping, uncertain cost allocation between personal and business expenses, and improper accounting procedures.[6]

Changes in the way regulatory commissions deal with the problems of small water systems are rapidly unfolding. Some of the states with fairly aggressive viability policies already in place include California, Connecticut, Georgia, Maryland, Missouri, New Jersey, Nevada, Pennsylvania, and Washington. Other states with considerable activity include Arizona, Kentucky, Massachusetts, New Hampshire, Utah, and Vermont.

Still, there is much work to be done in developing effective viability and nonproliferation policies. A Pennsylvania utility regulator provided the following blueprint for state commission action:[7]

- The *first* thing regulators must do is recognize that regulation of water companies will require more of our time in the future if adequate solutions to the troubled water company problem are to be found.
- *Secondly*, regulators must adopt the principle that a water utility to be successful must have competent management and adequate financing.
- *Thirdly*, regulators must identify companies that need help.
- *Fourthly*, assuming a takeover by a healthier private company, regulators must resolve to provide adequate incentives to such companies.
- *Fifthly*, if the situation is truly intolerable, with no possibility of improvement in sight, regulators must consider encouraging a voluntary sale, or forcing a sale, to a larger private company or to a municipality.
- *Sixthly*, longer-term solutions must be considered.

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[6] Public Utilities Commission of Ohio, *1990 Annual Report Review of Water and Sewer Companies* (Columbus, OH: Public Utilities Commission of Ohio, 1992).

[7] Excerpts from James H. Cawley, "The Takeover of Troubled Water Companies," *Proceedings of the Fourth Biennial Regulatory Information Conference* Columbus, OH: The National Regulatory Research Institute, 1984), 359-69.

- *Lastly,* regulators must recognize that only an entity with strong water management skills and technical expertise, great financial flexibility, and the ability to employ economies of scale can solve the troubled water company problem.

For water utility regulators, the emergence of new water systems and the precarious viability of so many existing small water systems continue to be the principal areas of concern. As noted above, defining the problem in terms of proliferation versus viability is the first order of business.

Proliferation Defined

This study began as one aimed at the "nonproliferation of nonviable water systems," meaning a key focus of the study would be on methods for thwarting the emergence of new nonviable systems, or methods of "birth control." In keeping with this metaphor, nonviable water systems are sometimes referred to as "orphans."[8] These themes remain central to this report. However, the empirical evidence suggests that the proliferation of water systems may not be as pervasive a problem today as it once may have been. In the past two or three years, some states appear to have brought the proliferation problem under more control.

The historical development of the water utility industry in the United States, like other public utilities, reflects substantial growth. As table 1-2 reveals, more than 3,000 systems existed before the end of the nineteenth century. Initially, the vast majority of systems were privately owned, although the proportion of publicly owned systems grew steadily and eventually claimed the majority. Today, the number of community water systems in the United States is about 60,000.[9]

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[8] James R. McQueen, "Takeover of Small Failing Water Systems," *Proceedings of the Annual Conference of the American Water Works Association, 1991* (Denver, CO: American Water Works Association, 1991), 341-45.

[9] According to the EPA, there exist another 140,000 noncommunity water systems, which are further subdivided into transient and nontransient systems. These systems are not analyzed in this report because they generally are not considered public utilities.

TABLE 1-2
HISTORICAL DEVELOPMENT OF WATER SYSTEMS IN THE UNITED STATES

Year	Publicly Owned	Privately Owned	Total	Percent of Total Public	Percent of Total Private
1800	1	15	16	6.3%	93.7%
1810	5	21	26	19.2	80.8
1820	5	25	30	16.6	83.4
1830	9	35	44	20.5	79.5
1840	23	41	64	35.9	64.1
1850	33	50	83	39.7	60.3
1860	57	79	136	41.9	58.1
1870	116	127	243	47.7	52.3
1880	293	305	598	49.0	51.0
1890	806	1,072	1,878	42.9	57.1
1896	1,690	1,489	3,179*	53.2	46.8

Source: M. N. Baker (1989) as reported in Charles F. Phillips, Jr., *The Regulation of Public Utilities* (Arlington, VA: Public Utilities Reports, Inc., 1988), 759.

* There also existed seventeen additional water systems of which twelve were of joint ownership and five were of unknown ownership.

Table 1-3 presents U.S. EPA data on the number of community water systems in existence as of the beginning of 1992 according to system size. The anomaly here is that roughly 13 percent of the water systems serve 89 percent of the population, while more than 87 percent of the water systems serve only 11 percent of the population. The structure of the water supply industry is one supporting a vast number of small systems, many serving populations fewer than 500.

Smallness, of course, is a relative issue. The EPA generally classifies systems serving a population under 3,300 (about 1,000 service connections) as small, although other subcategories also are used. The states use different definitions of smallness, sometimes based on service connections, sometimes based on population served, and sometimes based on utility revenues.[10] Regulatory standards and policies sometimes vary according to system size. Federal drinking water regulations do not apply to

[10] Janice A. Beecher and Ann P. Laubach, *1989 Survey on State Commission Regulation of Water and Sewer Systems* (Columbus, OH: The National Regulatory Research Institute, 1989).

TABLE 1-3
WATER SYSTEMS AND POPULATION SERVED, 1992

System Size by Population Served*	Number of Community Water Systems	Percent of Total Systems	Population Served (000)	Percent of Population Served
Smaller Systems				
25-100	18,388	31.2	1,038	.4
101-500	18,465	31.4	4,602	2.0
501-1,000	6,331	10.8	4,660	2.0
1,001-2,500	6,588	11.2	10,739	4.6
2,501-3,300	1,518	2.6	4,390	1.9
Total < 3,300	51,290	87.1	25,429	10.9
Larger System[illegible]				
Over 3,300	7,570	12.9	207,587	89.1
All Systems	58,860	100.0	233,017	100.0

Source: U.S. [illegible]ironmental Protection Agency, *Federal Reporting Data System FRDS-II* (computer p[illegible]ut dated 2/25/92). Percentages for size categories were calculated by the authors. To[illegible]re affected by rounding.

* Populatio[illegible]ved (not connections).

systems ser[illegible]ewer than twenty-five customers. Washington state, however, includes sys[illegible]serving as few as two connections under the jurisdiction of its Departmen[illegible]ocial and Health Service, which is responsible for drinking water regulation. [illegible]ster agency, the Utilities and Transportation Commission exempts from econo[illegible]gulation systems having less than $300 in annual operating revenues p[illegible]omer or fewer than 100 customers.[11] The lines of jurisdiction, in other word[illegible]drawn differently from state to state and even from agency to agency wit[illegible]tate.

11 [illegible]ommissions selectively exempt systems on the basis of size, which can limit t[illegible]rspective on the small systems problem. Iowa, for example, does not regula[illegible]ms serving fewer than 2,000 customers, leaving only one under the commissi[illegible]hority.

Further detail on the structure of the industry is found in table 1-4, which compares systems by size and according to specific types of ownership. Among small water systems, the most predominant form is local, municipally owned systems (30.5 percent). The next largest category consists of systems affiliated with mobile home parks (19.3 percent). In general, most small water systems are considered privately owned or ancillary systems. These ownership forms frequently place systems under the jurisdiction of the state public utility commissions.

Recent EPA data (1991/1992) on the total number of water systems are compared with data from five years earlier (1986/1987) in table 1-5. On the whole, the number of systems declined slightly (by 761 systems or 1.3 percent) over the five-year period.[12] Most interesting is the finding that within the smallest size category (systems serving 100 or fewer customers), the number of systems declined in a fairly significant way (by 1,290 systems or 6.6 percent). Indeed, this was the only size category to experience a decline over the period. In the other "smaller systems" groupings, the increase in systems was fairly modest. For the "larger systems" (serving 3,300 or more customers), more substantial gains were made.

The relative stability in the aggregate number of U.S. water systems over the 1980s appears to challenge some commonly held assumptions about proliferation. The small decline in the total number of systems and the decline in the number of systems in the smallest category might suggest that proliferation has slowed (along with the economy in general and real estate markets in particular) or even that some measure of consolidation may be underway. The data are imperfect in that keeping track of water systems (especially the very small systems) is extremely difficult.[13] Moreover, the use of aggregate data could mask proliferation trends within particular regions. The numbers, of course, are not so dramatic as to suggest that public policies to address proliferation are misdirected. On the contrary, these policies are essential to real progress in reducing the number of nonviable systems.

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12 EPA sources indicate that the total number of water systems has hovered around 60,000 for at least a decade.

13 Underestimation bias in the data would probably affect the early data and the later data similarly. If anything, undercounting of systems would be more likely in the earlier days of the Federal Reporting Data System, which would result in a slightly greater decline in the total number of systems as counted by the EPA.

TABLE 1-4

ESTIMATED COMMUNITY WATER SYSTEMS BY OWNERSHIP, 1992

Type of Ownership	Serving <3,300 pop.(a) Number	Pct.	Serving >3,300 pop.(a) Number	Pct.	Total Systems	Pct.
Public						
Local, municipal government	17,978	30.5%	8,082	13.7%	26,060	44.3%
Federal government	434	.7	158	.3	592	1.0
On Indian land	139	.2	3	.0	142	.2
Subtotal	18,551	31.5	8,243	14.0	26,794	45.5
Private						
Investor-owned						
Financially independent	6,528	11.1	999	1.7	7,528	12.8
Financially dependent (b)	899	1.5	204	.3	1,105	1.9
Homeowners' association (c)	6,651	11.3	259	.4	6,908	11.7
Other	633	1.1	108	.2	741	1.3
Not available	156	.3	44	.1	200	.3
Subtotal	14,865	25.3	1,615	2.7	16,481	28.0
Ancillary						
Mobile home parks	11,379	19.3	0	.0	11,379	19.3
Institutions	600	1.0	0	.0	600	1.0
Schools	502	.9	11	.0	513	.9
Hospitals	102	.2	0	.0	102	.2
Other	2,958	5.0	0	.0	2,958	5.0
Not available	35	.1	0	.0	35	.1
Subtotal	15,573	26.5	11	.0	15,585	26.5
All Systems	48,989	83.2%	9,871	16.8%	58,860	100.0%

Source: Authors' construct using U.S. Environmental Protection Agency, *Federal Reporting Data System FRDS-II* (computer printout dated 2/25/92) and Frederick W. Immerman, *Financial Descriptive Summary: 1986 Survey of Community Water Systems* (Washington, DC: Office of Drinking Water, U.S. Environmental Protection Agency, 1987), table 2-2. System percentages for each category reported in the 1986 survey were applied to the aggregate system total available in early 1992. Some figures are affected by rounding.

(a) Population served (not connections).
(b) Financially dependent on parent company (EPA categorization).
(c) Homeowners' association or subdivision (EPA categorization).

TABLE 1-5

CHANGE IN THE NUMBER OF COMMUNITY WATER SYSTEMS IN THE UNITED STATES 1986/1987 TO 1991/1992

System Size*	Water Systems 1986/1987		Water Systems 1991/1992		Change	Percent Change
	Number	Percent	Number	Percent		
Smaller Systems						
Under 101	19,678	33.0%	18,388	31.2%	-1,290	-6.6%
101-500	18,330	30.7	18,465	31.4	+135	+.7
501-1,000	6,310	10.6	6,331	10.8	+21	+.3
1,001-3,300	7,940	13.3	8,106	13.8	+166	+2.1
Larger Systems						
3,301-10,000	4,210	7.1	4,231	7.2	+21	+.5
10,001-50,000	2,534	4.3	2,649	4.5	+115	+4.5
50,001-75,001	240	0.4	272	.5	+32	+13.3
75,001-100,000	104	0.2	105	.2	+1	+1.0
Over 100,000	275	.5	313	.5	+38	+13.8
Total	59,621	100.1%	58,860	100.1%	-761	-1.3%

Source: U.S. Environmental Protection Agency, *Federal Reporting Data System FRDS-II* (computer printouts dated 5/23/88 and 2/25/92). Some of the original categories reported were collapsed for comparison purposes. Percentages were calculated by the authors and may not add due to rounding.

* Population served (not connections).

State public utility regulators often use utilities rather than water systems as a unit of analysis.[14] Data on the number of water utilities under the jurisdiction of the commissions (and other survey data on the topic of small system viability) appear in appendix A of this report. Different types of water utilities are regulated by the states to a different extent:[15]

- Investor-owned (45 commissions)
- Municipal (14 commissions)
- Water districts (9 commissions)
- Cooperatives (13 commissions)
- Homeowners' associations (9 commissions)
- Other systems (7 commissions)

The scope of commission jurisdiction varies with the type of utility regulated, but investor-owned (or privately owned) utilities are regulated most comprehensively. States reporting 100 or more jurisdictional investor-owned water utilities (100 utilities or more) for 1990 were: Texas (1,402), Arizona (378), Florida (357), North Carolina (336), New York (317), Pennsylvania (269), California (225), and Louisiana (116). In most of these states, the water system viability issue has been high on the regulatory agenda.

The change in the number of investor-owned water utilities between 1980 and 1990 is reported in appendix A (table A-8) and arrayed in table 1-6.[16] Overall, thirteen states experienced an increase in the number of jurisdictional utilities, thirty experienced a decline, and two (Delaware and Kansas) experienced no change. Not surprisingly, big increases in the number of jurisdictional investor-owned water utilities are apparent for Texas (+957) and Florida (+97), followed by South Carolina (+20), Utah (+15), and Nevada (+10). At the other end are New York (-174), California (-121), Arizona (-97), Pennsylvania (-76), and Connecticut (-45).

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14 Many individual water systems may be subsumed under the ownership of one utility, which may make it hard to assess proliferation in the number of systems.

15 Beecher and Laubach, *1989 Survey on State Commission Regulation*. Commission regulation of water systems is nonexistent in Georgia, Minnesota, Nebraska, North Dakota, South Dakota, and Washington, D.C.

16 These data may not be completely reliable, and should be used with care, but are the best available. As in the federal data, any bias in the data due to undercounting of utilities would likely affect both data points and would not be expected to affect the general results.

TABLE 1-6
STATES ARRANGED BY CHANGE IN THE NUMBER OF JURISDICTIONAL INVESTOR-OWNED WATER UTILITIES

State	1980	1990	Change	Percent
Texas	445	1,402	+957	+215%
Florida	260	357	+97	+37%
South Carolina	52	72	+20	+39%
Utah	18	33	+15	+83%
Nevada	13	23	+10	+77%
Vermont	71	80	+9	+13%
New Hampshire	31	40	+9	+29%
New Mexico	30	38	+8	+27%
Montana	27	35	+8	+30%
Washington	55	60	+5	+9%
Missouri	75	78	+3	+4%
Hawaii	8	11	+3	+38%
Idaho	22	23	+1	+5%
Delaware	14	14	0	0%
Kansas	7	7	0	0%
Wyoming	17	16	-1	-6%
Rhode Island	8	7	-1	-13%
Virginia	73	70	-3	-4%
Alaska	24	21	-3	-13%
Wisconsin	15	12	-3	-2%
Alabama	17	13	-4	-24%
Tennessee	13	9	-4	-31%
North Carolina	343	336	-7	-2%
Ohio	42	35	-7	-17%
Colorado	12	5	-7	-58%
Arkansas	12	3	-9	-75%
Kentucky	46	36	-10	-22%
West Virginia	70	58	-12	-17%
Massachusetts	51	37	-14	-27%
Iowa	15	1	-14	-93%
Oklahoma	46	30	-16	-35%
Michigan	18	1	-17	-94%
Illinois	73	55	-18	-25%
Oregon	25	6	-19	-76%
Maine	61	38	-23	-38%
New Jersey	88	64	-24	-27%
Louisiana	144	116	-28	-19%
Maryland	60	28	-32	-53%
Mississippi	108	71	-37	-34%
Connecticut	106	61	-45	-42%
Pennsylvania	345	269	-76	-22%
Arizona	475	378	-97	-20%
Indiana	123	23	-100	-81%
California	346	225	-121	-34%
New York	491	317	-174	-35%

Source: Appendix A, table A-8.

Although not statistically tested, the change in the number of investor-owned utilities over the period does not seem to be consistently related to population or other major demographic patterns, meaning that other factors appear to be at work.

* The proliferation of systems in Florida is largely explained by economic growth and real estate development. Texas, too, was affected by these factors but by other changes as well. In 1986, jurisdiction over water utilities was transferred from the state's utility commission to the Texas Water Commission. What followed was a concerted effort on the part of Commission staff to locate and register systems that were under the agency's jurisdiction but not accounted for. A few systems that had been grandfathered under the change in state regulation were eventually added to the rolls as well. The Commission also continued to refine its definitions of jurisdictional homeowners' associations and cooperatives. Both Texas and Florida continue to experience pressure in terms of the large numbers of pending certification cases. In 1989, Texas had 152 cases pending and Florida had 75; the total for all states was 627.[17]

Nevertheless, proliferation (that is, *growth* in the number of systems) may not be as pervasive a problem today as might be assumed. The decline in the investor-owned water utility population can partly be attributed to economic factors, but the role of state policy in contributing to this trend may be equally relevant. Many states, such as Arizona, California, Connecticut, Florida, Illinois and South Carolina, have implemented fairly aggressive policies for slowing or reversing the proliferation trend, especially since the mid-1980s. Other states could follow Texas's lead in trying to locate more jurisdictional utilities.[18] However, many of these renegade utilities are very small and in several states they already may be exempt from public utility regulation on the basis of size or other criteria.

These findings should in no way undermine the priority of nonproliferation (namely, of nonviable water systems) as a matter of public policy. Many states continue to experience significant growth in the number of jurisdictional utilities. Most systems not under the commission's jurisdiction still must be regulated by state drinking water authorities. Controlling the emergence of water systems is

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17 Janice A. Beecher and Patrick C. Mann, *Deregulation and Regulatory Alternatives for Water Utilities* (Columbus, OH: The National Regulatory Research Institute, February 1990).

18 In New Hampshire, for example, the commission intends to investigate several hundred such systems.

perhaps the most essential of all viability policies; without nonproliferation policies the task of improving viability is made much harder. Indeed, most policies toward small water systems correctly address proliferation and viability simultaneously. While, as a distinction can be made between policies toward emerging systems and policies toward existing systems, as discussed in chapters 3 and 4, both have the common goal of nonproliferation of nonviable small water systems.

Viability Defined

Dictionary definitions treat viability in terms of survival under adverse conditions. Survival is an issue for mortal beings and business entities alike; indeed, the latter's life expectancy is probably shorter. Failure is perceived as especially disastrous when a business provides a service regarded as essential, as in the case of public utilities.

In the study of small water systems, several useful definitions of viability have emerged. According to Wade Miller Associates, Inc., a viable water system is one that is self-sustaining, and that has the commitment, and the financial, managerial, and technical capability to meet performance requirements reliably on a long-term basis.[19]

Somewhat more attention has been paid to defining "nonviability." Robert Heater defines a nonviable water system in terms of four issues: lack of motivation to operate properly, lack of ability to operate properly, lack of money to operate properly, and lack of ability to sell at a reasonable price due to lack of rate base, size, or geographic location.[20] This definition encompasses an emerging perspective that emphasizes how a community's ability to pay for the full cost of water service can determine water system viability.[21]

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19 Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems In Pennsylvania* (Arlington, Virginia: Wade Miller Associates, Inc., 1991), 5-1.

20 Robert B. Heater, "The Problems of Small Water Companies as Viewed by the Owner of One," *Proceedings of the Fifth NARUC Biennial Regulatory Information Conference* (Columbus, OH: The National Regulatory Research Institute, 1986), 1412.

21 A.W. Marks of the U.S. Environmental Protection Agency's Office of Ground Water and Drinking Water is an advocate of this perspective.

Regulators frequently link nonviability to problems of regulatory compliance. The EPA has defined nonviable water systems as those "with technical, financial, or managerial weaknesses that may render them incapable of complying with drinking water regulations."[22] Most state drinking water agencies probably conceive of viability in similar terms. The three components of this definition--technology, finance, and management--make up what is sometimes known as the "three-legged" stool on which viability rests. Emerging viability policies reflect this emphasis.

Staff members of many state public utility commissions employ definitions of viability (or nonviability), a sample of which appears in table 1-7. Some, like New Hampshire's, echo the three-legged-stool definition. Most, however, reflect the utility commission's interest in the nitty-gritty of ratemaking, defining viability in such terms as unreasonable rates (California), inadequate cash flow (Michigan), and the public interest in general (Wisconsin). What is noteworthy about these definitions is the diversity among the commissions in defining water system viability, revealed not only by the eleven commissions represented here but by the other commissions that did not report a working definition for their jurisdiction. Viability to a degree is an "I-know-it-when-I-see-it" phenomenon. While most regulatory commissions put forth neither a definition of viability nor systematic evidence about the condition of their small water systems, anecdotal testimony abounds. Small water systems are reputed to have been abandoned, given away, traded away, and even lost in poker games (not just in Texas). Most seasoned commission staff members can provide a good anecdote or two along these lines.

Finally, emerging definitions of viability go beyond the traditional considerations. Many are focused on larger institutional factors that may influence water system viability, especially in terms of regulatory and structural alternatives. In these terms, solutions to the viability problem may rest outside of the water utilities themselves. While proliferation may be a problem limited to certain geographic areas, viability is not. Moreover, without vigilant public policies, the potential for further proliferation of nonviable water systems still lingers. Policy solutions, therefore, are best structured with an emphasis on viability for both emerging systems and those already in existence.

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22 U.S. Environmental Protection Agency, *Ensuring the Viability of New, Small Drinking Water Systems: A Study of State Programs* (Washington, DC: U.S. Environmental Protection Agency, 1989), i.

TABLE 1-7
SOME COMMISSION STAFF DEFINITIONS OF VIABILITY/NONVIABILITY

California	One that cannot exist without charging unreasonable rates.
Connecticut	A system that is unable or unwilling to provide adequate service to its customers.
Illinois	An independently owned and operated system, generally serving 500 customers or less that is unable to hire sufficient management and operator expertise to operate as a utility.
Kansas	A system that is unable to provide efficient and sufficient service.
Massachusetts	The person(s) who will own and operate the system must demonstrate to the Department of Public Utilities that they have the technical, managerial, and financial resources to operate and maintain the system in a reliable manner and provide continuous adequate service to consumers.
Michigan	A system that cannot operate under its current cash flow.
New Hampshire	One whose management does not have sufficient managerial, financial, and technical expertise.
New Mexico	A water system that does not meet the requirements of commission rules; a water system incapable of sustaining itself.
Tennessee	Where rates to provide service would be prohibitive to customers.
Utah	Ideally, a water company owns sufficient water rights, has adequate sources of water, and owns its physical water plant. It is able to recover its operating costs in its rates as well as earning a return on its investment. It has cash reserves sufficient to cover extraordinary repairs or expense and can truly be considered viable.
Wisconsin	Generally defined as a system that would not be in the public interest to construct.

Source: *1991 NRRI Survey on Commission Regulation of Water Systems.* Other states may have working definitions or related rules or statutes not reported here.

A Policy Framework

A need exists for a framework to organize the various policies to improve the viability of small water systems. As the earlier discussion suggests, specific dimensions of viability are identifiable. Three dimensions involve characteristics specifically and directly related to water system performance, all of which can be used to diagnose viability problems:

- **Technical** issues concern the operational aspects of the water delivery infrastructure and technical compliance with drinking water regulations.
- **Financial** issues concern the financial resources needed for supporting a viable water system.
- **Managerial** issues concern the competence of utility management in planning for, establishing, and operating a viable water system that meets all appropriate regulatory standards.

Performance in general is defined in terms of internal characteristics of public utilities (such as management competence) but can be shaped by external forces as well (such as a community's ability to pay or a regulatory approval of rates). The technical, financial, and managerial elements of performance are critical, as seen throughout the literature on water system viability.

The performance dimensions provide a useful diagnostic tool, but they do not encompass some of broader institutional forces that affect water system viability and the overall viability of the water supply industry. Institutional arrangements are determined by public policies as well as market forces. They shape how utility services are provided, which in turn affects how individual utilities perform. The institutional issues affecting water system viability also can be subdivided into three distinct dimensions:

- **Regulatory** issues concern the requirements, constraints, and performance incentives imposed on the water supply industry, especially in certifying new water systems and providing oversight for existing systems.
- **Structural** issues concern relationships among water systems aimed at improving efficiency, especially consolidation measures that exploit economies of scale and scope.

- **Comprehensive** issues concern substantial institutional changes of a regulatory and structural nature that affect the long-term viability of the water supply industry, especially integrated resource planning.[23]

Some public policies (such as loans and grants to water systems) are intended to influence utility performance directly. While these solutions may treat the symptoms of distress, it is uncertain whether they will improve long-term survival rates. For this reason, there is a growing interest in policies affecting the institutional character of water supply, including the way it is structured and regulated, because they may offer more effective and permanent solutions.

Institutional policy alternatives are somewhat cumulative. Regulatory policies begin with the immediate goal of improving performance, structural policies turn to the intermediate goal of efficiency, and comprehensive policies turn to the ultimate goal of viability. Institutional issues arise both for emerging and existing water systems. For example, there is a strong emphasis on regulatory solutions (such as strengthening the certification process) for emerging systems. Structural solutions (such as consolidation of the water supply industry) can be developed for both emerging and existing systems. The most comprehensive solutions address the viability of both emerging and existing systems. That is, they seek to control the proliferation as well as improve overall viability.

For each of the six viability dimensions, specific policy questions arise, as summarized in table 1-8. As a self-assessment tool, these questions can help identify problem areas as well as point to potential solutions.

The distinction between the performance and institutional dimensions is relevant to the organization of the remainder of this report. The performance dimensions are used for describing the condition of small water systems (chapter 2) and the institutional dimensions are used to organize the discussion of viability policies (chapters 3 and 4). Assessment methods emphasize the performance dimensions, although not exclusively (chapter 5 and 6). In considering future directions, institutional alternatives are of critical importance (chapter 7).

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23 For a similar emphasis on the importance of comprehensive policy and planning, see Wade Miller Associates, Inc., *State Initiatives*.

TABLE 1-8
DIMENSIONS OF WATER SYSTEM VIABILITY AND SOME KEY QUESTIONS

PERFORMANCE DIMENSIONS	
Technical	· Can the system provide safe, adequate, and reliable water service? · Does the system comply with drinking water regulations? · Does the system operate with engineering efficiency? · Is the system technologically current? · Is the system run by a certified operator?
Financial	· Does the system have or can it acquire the capital need to provide water service that meets regulatory standards? · Do the existing or proposed rates accurately, adequately, and equitably reflect the full cost of water service? · Are the system's customers willing and able to pay the rates necessary for the provisions of water service?
Managerial	· Does the system benefit from management expertise? · Is management competent to comply with environmental, public health, and economic regulations? · Does the system have a business plan to assure viability? · Does management avail itself of outside resources and assistance? · Is management responsive to customer needs?
INSTITUTIONAL DIMENSIONS	
Regulatory	· Is the certification process for emerging water systems adequate for assuring viability? · Is regulatory oversight of existing water systems adequate for assuring their viability? · Are regulators implementing appropriate tools for improving the viability of the water industry?
Structural	· Is the water supply industry structured to exploit economies of scale and scope and operate efficiently? · Are there barriers to industry restructuring? · Are there barriers to coordination and sharing of facilities?
Comprehensive	· Are governmental roles in water resource management coordinated? · Is integrated resource planning a guiding paradigm? · Does the regulatory system promote structural solutions, such as consolidation and other means of achieving economies of scale, economies of scope, and optimal performance?

Source: Authors' construct.

CHAPTER 2

DIMENSIONS OF WATER SYSTEM PERFORMANCE

This chapter assesses the present condition of small water systems in terms of the performance dimensions introduce in chapter 1–financial, managerial, and technical. The flipside of viability, of course, is failure. Although few water systems actually file for bankruptcy, the bankruptcy literature provides fertile ground for understanding the principal dimensions of water system failure. This is not to suggest that all water systems or even all small water systems are destined to fail. Rather, this study serves to point out the signs of failure to be used by the industry and regulators in the interest of diagnosis and prevention.

A Bankruptcy Perspective

A *Wall Street Journal* article citing Dun & Bradstreet data reported a record 87,266 business bankruptcies in the United States during 1991.[1] This figure is up 45 percent from the 60,000 bankruptcies reported in 1990, the worst since the recession of the early 1980s.[2]

The obvious trend in business failure has been upward with no region or industrial sector spared. It is no surprise that bankruptcies increase during recessions, leading analysts to cite "economic factors" as the major cause of business failures, but there are exceptions. Bankruptcies among banks and savings and loans may be less related to economic downturns since such failures predated the 1990-91 recession. Deep cyclical and secular declines in energy and real estate markets caused many financial institutions to fail in the late 1980s. The 1990-91 recession merely exacerbated these trends.

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1 *The Wall Street Journal* (February 21, 1992): 83.

2 Dun & Bradstreet defines failure to include firms that ceased operations following assignment or bankruptcy; ceased operations with losses to creditors after such actions as foreclosure or attachment; voluntarily withdrew leaving unpaid debts; were involved in court actions such as receivership, reorganization or arrangement; or voluntarily compromised with creditors (Dun & Bradstreet, *Business Failure Record*, 1989); Suein Hwang, "Business Failures Rose 20% in '90 Amid Recession," *The Wall Street Journal* (March 31, 1991): 2A.

The most recent trends in failure by industry are shown in table 2-1. The large increase in 1990 was from a relatively low number in 1989 and occurred across all industries including transportation and public utilities. In table 2-2 the causes of failure are presented. Economic factors, especially insufficient profits, are the major cause in every year. Lack of business experience also has been consistently among the top few causes. However, lack of experience shows the greatest percentage increase in 1989, and economic factors declined dramatically in 1989.

The business failure trends show that in every industry a major cause of failure was beyond the control of individual firms, since failure was due to economic factors such as industry weakness or insufficient profits. But a major cause of failure is lack of business knowledge or experience, a key issue of concern in the certification of new water systems.

The common assumption is that the failure rate is relatively high among small businesses and among new businesses. Table 2-3 shows that small firms do have a high failure rate. But the failure rate among relatively large firms ($100,000 or more in liabilities) is high as well (as table 2-3 shows), although liabilities of up to $1 million arguably are not really large. Table 2-4 shows that 50 percent of failures in 1989 affected firms under five years old. But 25 percent were between six and ten years old and 25 percent were "old" firms (over ten years old).

The data illustrate an important reality: both new firms and small firms are at risk of failure. This is consistent with the concern among regulators about the viability of emerging small water systems as well as with existing systems. Fortunately, there are some offsetting data about new and small firms that suggest many can and do survive. However, one key to survival and success is the presence of economic growth. This variable is critical to the success of new firms generally and a regulatory requirement in some cases, such as for firms entering the banking industry.[3]

A major study on this topic was sponsored by the Small Business Administration (SBA).[4] The data indicate that 40 percent of all new and small

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[3] Economic growth is an essential requirement in the chartering of *all* new banks by the United States Office of the Comptroller of the Currency (OCC) and the state banking commissions, and for insurance approval by the Federal Deposit Insurance Corporation (FDIC).

[4] Bruce Phillips and B. A. Kirchhoff, "Formation, Growth and Survival: Small Firm Dynamics in the U.S. Economy," *Small Business Economics* 1 (1989): 65-74.

TABLE 2-1

BUSINESS FAILURES BY INDUSTRY, 1987-1990

Industry	1987	1988	1989	1990
Agriculture, Forestry, Fishing	3,766	2,029	1,540	1,727
Mining	627	500	351	381
Construction	6,735	7,140	7,120	8,072
Manufacturing	4,273	4,264	3,933	4,709
Wholesale trade	4,336	4,510	3,638	4,376
Retail trade	na	11,862	11,120	12,826
Finance, Insurance, Real Estate	na	2,884	2,932	3,881
Services	23,802	17,930	13,679	17,673
Transportation & Public Utilities	2,236	2,234	2,115	2,610
Nonclassified	546	3,744	3,884	4,177
Total	61,111	57,097	50,361	60,432

Source: Dun & Bradstreet, *Business Failure Record* (various years) and *News Release*, March 12, 1991.

na = not available.

TABLE 2-2

CAUSES OF BUSINESS FAILURES, 1987-1989

Cause of Failure	1987	1988	1989
Economic Factors	71.7%	57.2%	41.3%
Industry weakness	14.8	10.5	18.4
Insufficient profit	75.2	22.1	18.3
Poor growth prospect	9.0	19.6	.4
Finance	na	26.2	32.8
Heavy operating expense	na	11.7	13.5
Insufficient capital	na	5.8	10.5
Experience	20.3	12.0	20.1
Business ignorance	75.0	5.2	10.5
No managerial experience	12.6	2.6	1.5
Neglect	1.6	1.7	2.4
Fraud and Disaster	.7	1.7	1.8
Strategy Conflict	na	.9	1.1

Source: Dun & Bradstreet, *Business Failure Record* (various years).

TABLE 2-3

LIABILITY SIZE OF FAILED FIRMS, 1989

Firm Liability Size	Failed Firms	Percent
Over $1 million	2,807	5.6%
$100,000 to $1 million	14,272	28.3
$25,000 to $100,000	10,471	20.8
$5,000 to $25,000	3,708	7.4
Under $5,000	19,130	38.0

Source: Dun & Bradstreet, *Business Failure Record*, 1989.

TABLE 2-4

AGE OF FAILED COMPANIES, 1989

Age of Firm	Percent
1 year	9.0%
2 years	11.2
3 years	11.2
4-5 years	18.4
6-10 years	24.3
Over 10 years	25.9

Source: Dun & Bradstreet, *Business Failure Record*, 1989.

firms survived after six years. Those that experienced even modest economic growth (as measured by new employees hired) survived at a 63 to 74 percent rate after six years. It is clear that these high survival rates persisted across all industries, as shown in the table. Essentially, even a little economic growth produces high survival rates among new small companies.

Bankruptcy and Water Utilities

What do the above data have to do with water utilities? A review of failure trends is important for understanding the general pressures facing water companies although water utilities are unique in many ways. Macroeconomic conditions do not necessarily affect water companies to a significant degree because they are monopolies providing a product with a generally inelastic demand.[5] Thus water companies are somewhat insulated from recessions or sudden economic shocks like OPEC oil restrictions. Two major exceptions to this assertion, however, are the effect of real estate markets on new water systems and the dependence of existing systems on large customers.

Many small water systems are established on the basis on speculation about real estate development and growth. Growth is essential to the success of most new firms (as also discussed in chapter 6). Yet per capita water demand is highly stable, meaning that the only real growth in system demand comes from adding new customers through housing sales. Lack of expected growth (namely less-than-full development of a subdivision) is probably the most prevalent cause of distress for young water systems.[6] Also, all water systems are vulnerable to the effects of the economy if they are dependent on one or a few industrial customers who are not recession proof. If these large water customers are forced to close up shop, the utility may have trouble covering its fixed costs.

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[5] For products with inelastic demand curves, consumers are less responsive to changes in price. For water, indoor use is considered very inelastic and more so than outdoor use.

[6] Staff members in New York point out that there is no mechanism in place to ensure financial viability in the case of a real estate development that does not meet expectations in terms of housing sales and therefore cannot support the cost of operating the water system.

Although somewhat insulated from economic cycles, water systems can experience many of the other manifestations of distress listed earlier in table 2-2. These problems include insufficient profits, management inexperience, heavy operating expenses, and insufficient investor capital. Many small water utilities encounter these difficulties even when the economy in which they operate is healthy. For distressed firms, more than one problem is usually at work. Management inexperience combined with lack of growth, for example, means two strikes against a system from the start.

While it is not easy to know with certainty how many jurisdictional water companies are financially distressed, it is clear from available data that many small water utilities are technically bankrupt and have been for years. Legal or accounting bankruptcy occurs when a firm has negative net worth, meaning that its liabilities exceed its assets. Insolvency means that a firm cannot pay its current bills in a timely fashion, that is, the firm has missed payments on accounts payable, defaulted on bank loans, or on scheduled interest or note payments, and so on. Basically its *current* liabilities exceed its current assets.

Inadequate capital (equity or debt) is frequently assumed to be a critical problem for new small firms, but the Dun & Bradstreet data do not show this as a consistent source of failure though it was very important in 1989. In banking studies capital adequacy was a major cause of bank closures but the measure used in the studies frequently referred to retained earnings rather than original capital by owners or creditors. Capital infusions are an important ingredient in the restructuring of distressed banks today in the same way that capital infusions are essential even in a Chapter 11 bankruptcy reorganization plan. New capital frequently is required in the solution to a water utility's capital shortage as well.

How many jurisdictional water companies are technically bankrupt? Few utilities are in bankruptcy in the legal sense that they have filed with Federal District Bankruptcy Court for protection during reorganization (Chapter 11 filing) or for liquidation (Chapter 7 filing). In its published data Dun & Bradstreet includes public utility bankruptcies in its Transportation and Public Utilities category, but is not specific about which of these involved water utilities.

The only available data specifically about water utility bankruptcy and/or default rates (nonpayment of notes, loans, interest) among jurisdictional water companies is presented in table 2-5. It was collected in a telephone survey of commissions by Kenneth Hall of National Guaranty Management, Inc. in 1990. The

TABLE 2-5

DEFAULTS AND BANKRUPTCY OF WATER UTILITIES BY STATE, 1990

State	Number of Defaults	Number of Bankruptcies
Arizona	1	Many*
Florida	5-6	1 (by parent company)
Louisiana	2	3-4
Maine	1	1
Massachusetts	0	2
Mississippi	1	1
New Jersey	0	1
North Carolina	0	3-4*
Pennsylvania	0	2
South Carolina	0	3
Texas	0	10 per year over last 5 years*
Utah	1	1
Virginia	0	1 (by parent company)
Total	12	31

Source: 1990 survey of state commission staff by National Guaranty Management, Inc. (used with permission).

* Personal bankruptcies of company owners or developers, not necessarily the water company they own.

total number of defaults shown is twelve, six of which occurred in Florida. While there are thirty-one bankruptcies indicated, sixteen involved developers rather than the owned water utility. These are scattered throughout the states and are cumulative over many years. For example, the two bankruptcies in Massachusetts were reported to have occurred in 1906 and 1936. The data also are known to be somewhat incomplete. For example, other sources indicate there were four water utility bankruptcies in Ohio between 1987 and 1990. The difficulty in collecting this type of data is certainly understandable given the limits on institutional memories.

Even though sketchy, the bankruptcy data on investor-owned water utilities were consistent with expectations. A large number of legal bankruptcies was not expected and was not found. A key reason for limited bankruptcies appears to be that commissions try to intervene before distressed utilities are forced to renege on their obligation to serve. In a few rare cases, however, utilities may have turned to bankruptcy for rate relief. One rationale by the parent company for the four Ohio bankruptcies, for example, was that the procedure allowed the water systems to achieve rate increases through Bankruptcy Court larger what than they expected to achieve from the Ohio Public Utilities Commission.[7]

Unfortunately, although actual filings for bankruptcy are few the number of distressed small water companies apparently is many. For example, in the NRRI 1986 report on mergers among jurisdictional water companies, many of the sample companies used in the study (while identified by the commissions surveyed as successful) were in fact bankrupt; that is, they had negative net worth and liabilities greater than assets in 1985 and in several previous years.[8]

Throughout this report we refer to distressed water companies even though the term is relative with no legal meaning like bankruptcy or insolvency. The bankruptcy prediction models that we review and simulate later would simply try to identify their distress early enough to intervene. They are thus in the realm of "early warning" models like those used by federal banking agencies to identify

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[7] The four Ohio bankruptcies were subsidiaries of American Utilities, Inc. of New Jersey. Ironically, Ohio statutes later were revised in an attempt to bring these firms back under Ohio jurisdiction along with many other not-for-profit water companies.

[8] Patrick C. Mann, G. Richard Dreese and Miriam A. Tucker, *Commission Regulation of Small Water Utilities: Mergers and Acquisitions* (Columbus, OH: The National Regulatory Research Institute, October 1986).

distressed banks and saving and loans early enough to prevent their closure. For water utilities early intervention also is essential to survival.

Three Dimensions of Water System Performance

Characteristics of potentially nonviable water systems, all too familiar to many water utility regulators, are reported in table 2-6. To many regulators, the profile of a distressed small system is easy to sum up:

> Most troubled small water systems fall into one of the following categories: (1) they are obtained as a 100% donation by a developer to the owner/operator of a company attempting to operate as a valid operating company; (2) they are owned and operated by the developer; (3) they are a 'shell' corporation set up by a developer that he finances until all lots are sold, after which it is allowed to fold; they usually do not have enough customers to stand alone and generate enough money to operate effectively as a separate company (i.e. less than 1,000 customers). They were usually installed with everything at a bare minimum and they almost never have a real rate base.[9]

The substantial literature on the characteristics of small water utilities is cited throughout this report. As discussed in chapter 1, water system performance can be defined in technical, financial, and managerial terms. Using these dimensions as a guide, some of the key performance indicators used in assessing the water industry as a whole, and small systems in particular, are discussed below.

Technical Performance

The technical health of a water utility reflects its physical condition as well as its capacity to meet increasingly stringent drinking water regulations. Because technical health requires resources, it is especially dependent on the financial and managerial health of the firm.

The physical deterioration of small systems is often of paramount concern to regulators, ratepayers, and others. Upgrading a deteriorated system is costly and frustrating. Larger and more viable water systems may be more reluctant to take

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[9] Robert B. Heater, "The Problems of Small Water Companies as Viewed by the Owner of One," *Proceedings of the Fifth NARUC Biennial Regulatory Information Conference* (Columbus, OH: The National Regulatory Research Institute, 1986), 1411.

TABLE 2-6

CHARACTERISTICS OF POTENTIALLY NONVIABLE SMALL WATER SYSTEMS

Number of customers	· Typically between 50 and 500 customers.
Annual revenues	· From less than $5,000 up to $100,000.
Return on equity	· Considerably less than 15% return on equity; actual net income loss.
Fixed capital investment	· From less than $50,000 up to $500,000.
Physical plant deficiencies	· Rudimentary chemical treatment facility. · Inadequate wells and/or unreliable springs. · Pumps, electrical equipment and controls, distribution mains, and storage facilities are usually outmoded and/or inadequate; metering is minimal, if not nonexistent. · Systems barely meets or is deficient in meeting water quality standards; system-wide water pressure is minimal.
System ownership/ origin	· Systems installed by contractor, builder, or developer for the purpose of selling homes. · Systems in vacation or second-home developments. · Systems in nongrowth communities that have lost principal industries, and have few or no commercial customers. · Location with the residue of a former water system that directly served a particular industry and incidentally served local residential and commercial customers.
Management skills	· Lacking in the financial, engineering, legal, accounting, and operational skills necessary to adequately run the water system.
Other characteristics	· Poor service quality. · Inadequate existing rates; existing rate structure is devoid of conservation and seasonal use designs; rate filings are poor in quality. · Borrowing is almost nonexistent; when capital can be raised it is only at premium rates.

Source: Adapted from James H. Cawley, "The Takeover of Troubled Water Companies," *Proceedings of the Fourth NARUC Biennial Regulatory Information Conference* (Columbus, OH: The National Regulatory Research Institute, 1984), 359-69.

over such systems, particularly without special incentives, because they require so much attention and resource investment. Customers, too, may not welcome the service interruptions necessary to upgrade the water system.

According to a regional manager of one company, some small systems suffer from a host of physical problems and limitations:[10]

- Plastic mains and services are deteriorated due to type of material and age. In most cases, they are unrepairable.
- Mains are located on private property, in some cases, five to ten feet off the house foundation.
- Main and service break repairs require excavating on private property disrupting lawns, shrubbery, and so on. Restoration is seldom acceptable to the property owner.
- Very few valves exist to isolate the mains and services during main and service breaks increasing the number of customers involved in service outages.
- Curb valves do not exist requiring main shutdown for service line work and prohibiting nonpayment shutoffs.
- In most cases, locations of plastic mains and services are unknown and untraceable.
- Lack of blowoffs to flush the system causes problems with sediment in mains and services.
- Mains are along rear property lines with fences, storage building and shrubberies placed on top.
- Low pressure and flows due to leaking small diameter mains and services cause customer complaints. In some cases, customers refuse to pay their water bill.
- Small diameter steel mains are deteriorated and tuberculated restricting water flow.
- Many mains and services are shallow and freeze in cold weather.
- Some services, leaking of course, crossed septic fields.

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10 James R. McQueen, "Takeover of Small Failing Water Systems," *Proceedings of the Annual Conference of the American Water Works Association, 1991* (Denver, CO: American Water Works Association, 1991), 342-43.

Because of their physical condition, many small systems are more likely to have problems complying with drinking water standards. The U.S. Environmental Protection Agency, which administers the Safe Drinking Water Act (SDWA) through state primacy agencies, is phasing in a three-tiered system.[11] The first tier defines a "significant noncomplier" as one with violations posing the greatest risk to health. In the second tier are intermediate violators involving a short-term violation or one involving a low-level contamination that does not pose an immediate threat to public health. The third tier consists of all remaining violators. It is generally assumed that many of the significant noncompliers will be small water systems.

According to EPA data for 1991, the number of SDWA violations nationally (63,370) exceeded the number of water systems (58,860).[12] The number of systems in violation was 16,940, or 29 percent of the industry. Within the EPA's ten geographic regions, between 21 and 52 percent of water systems were in violation. Total violations for three regions exceeded 12,000; for one region, the number of systems in violation exceeded 3,600. However, it is important to note that the majority of the violations (about 85 percent) involve monitoring and reporting requirements. The remaining violations involve situations where maximum contamination levels (MCLs) have been exceeded. Unfortunately, a monitoring violation can mask MCL violations, which is why monitoring is so vital to implementation of the SDWA. Compliance with monitoring and reporting requirements is suggestive not only about technical capability but managerial capability as well, as discussed below.

Table 2-7 presents EPA compliance data (for MCLs and monitoring) according to the size of water systems, using the EPA's categories. Fully 81.4 percent of all *violations* are reported for systems serving 1,000 or fewer populations; 92.2 percent are for systems serving 3,300 or fewer populations. Nearly 90 percent of all *systems in violation* serve populations of 3,300 or less. As would be expected, the number of systems in violation as a percentage of systems within each size category

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[11] "EPA Revises Definition of SNC," *Mainstream* (A publication of the American Water Works Association) 34 no. 8 (August 1990), 9.

[12] U.S. Environmental Protection Agency, *Federal Reporting Data System FRDS-II* (computer printouts dated 2/25/92 and 3/3/92). Percentages were calculated by the authors. The EPA did not include 569 violations (66 systems in violation) because of insufficient data. These data are highly volatile and must be used with caution.

TABLE 2-7

EPA COMPLIANCE CHARACTERISTICS BY SYSTEM SIZE, 1991

System Size(a)	Water Systems Number	Water Systems Pct.	Total Violations Number	Total Violations Pct.	Systems in Violation Number	Systems in Violation Pct.	Systems in Violation as a % of Systems
Under 101	18,388	31.2%	22,909	36.2%	6,233	36.8%	33.9%
101-500	18,465	31.4	21,103	33.3	5,498	32.5	29.8
501-1,000	6,331	10.8	7,523	11.9	1,505	8.9	23.8
1,001-2,500	6,588	11.2	5,681	9.0	1,622	9.6	24.6
2,501-3,300	1,518	2.6	1,112	1.8	359	2.1	23.6
3,301-5,000	1,963	3.3	1,293	2.0	453	2.7	23.1
5,001-10,000	2,268	3.9	1,340	2.1	497	2.9	21.9
10,001-50,000	2,649	4.5	1,696	2.7	657	3.9	24.8
50,001-75,000	272	.5	103	.2	50	.3	18.4
75,001-100,000	105	.2	34	.1	18	.1	17.1
Over 100,000	313	.5	576	.9	48	.3	15.3
Total(b)	58,860	100.0%	63,370	100.2%	16,940	100.1%	28.8%

Source: U.S. Environmental Protection Agency, *Federal Reporting Data System FRDS-II* (computer printouts dated 2/25/92 and 3/3/92). Percentages were calculated by the authors. The EPA did not include 569 violations (66 systems in violation) because of insufficient data.

(a) Population served (not connections).
(b) Percentages may not add to 100 due to rounding.

is inversely related to system size. For the very smallest systems, more than a third are in violation; for the very largest, only 15 percent. However, in the middle are groupings of systems that still vary significantly in size but with rather comparable proportions of systems in violation. Only for systems serving populations greater than 50,000 do the systems in violation drop below 20 percent.

Compliance data by system size for water quality monitoring under the total coliform rule is reported in table 2-8. The majority of monitoring violations are associated with this rule. Again, while there are more violations for the smaller systems this is partially explainable because of the greater number of small systems. However, proportionally more small systems have difficulty complying with monitoring requirements. Major violations in routine reporting are especially significant for small water systems. However, repeat monitoring violations (major and minor) are substantially less than routine violations, even for small water systems.

Using the cutoff of 3,300 in population served, used often by the EPA to define small community water systems, compliance data for a dozen selected states and the United States as a whole (including territories) are presented in table 2-9. For the U.S. as a whole, 30 percent of the smaller systems are in violation compared with 23 percent of the larger systems. This pattern holds true for ten of the twelve states analyzed. For Connecticut, New Jersey and Texas, however, proportionally more larger systems were in violation than smaller systems. The number of violations (which again are predominantly monitoring violations) are highest in Pennsylvania, North Carolina, Florida, and Washington. Accounting for thirty-six percent of all violations, it is no wonder that these states are especially concerned about the effect of the SDWA on their jurisdictional water utilities.

These data seem to suggest a technical performance crisis in the water utility industry. However, it may be too early to pass judgment on the performance impact of the SDWA using EPA compliance data. Both regulators and regulatees are adjusting to the demands of this legislation. In fact, the long-term effect of the SDWA on the industry may be positive in terms of improving technical assistance efforts (such as "circuit rider" programs) and stimulating technological innovations (such as affordable and possibly portable treatment technologies for small water systems). Another positive effect of the SDWA in the long term may be the implementation of structural changes in the industry, such as satellite management and mergers. Still, it is obvious that financial and managerial resources of the

TABLE 2-8

COMPLIANCE WITH EPA MONITORING REQUIREMENTS
UNDER THE TOTAL COLIFORM RULE BY SYSTEM SIZE, 1991

Systems Size*	Routine Minor Viol.	Routine Minor Systems	Routine Major Viol.	Routine Major Systems	Repeat Minor Viol.	Repeat Minor Systems	Repeat Major Viol.	Repeat Major Systems
Under 101	812	546	3,568	1,934	201	186	372	315
101-500	800	598	2,282	1,439	201	183	300	245
501-1,000	267	213	477	346	53	46	85	73
1,001-2,500	567	433	296	244	89	81	67	64
2,501-3,300	144	94	40	33	17	17	10	10
3,301-5,000	163	117	54	49	27	23	12	12
5,001-10,000	196	127	38	35	32	28	24	24
10,001-50,000	220	128	31	26	28	28	23	22
50,001-75,000	15	9	3	3	5	5	6	3
75,001-100,000	4	4	0	0	1	1	3	3
Over 100,000	12	8	0	0	3	3	3	3
Total	3,200	2,277	6,789	4,109	657	601	905	774

Source: U.S. Environmental Protection Agency, *Federal Reporting Data System FRDS-II* (computer printout dated 3/3/92). The EPA did not include 569 violations (66 systems in violation) because of insufficient data.

* Population served (not connections).

TABLE 2-9

EPA VIOLATIONS BY SYSTEM SIZE FOR SELECTED STATES, 1991

State	Systems serving < 3,300 pop.		Systems serving > 3,300 pop.		Total Systems	
	Number	Percent	Number	Percent	Number	Percent
Arizona						
Number of systems	778	90%	83	10%	861	100%
Violations	202	91	40	9	442	100
Systems in violation	244	94	16	6	260	100
% systems in violation	–	31	–	19	–	30
California						
Number of systems	3,047	83%	621	17%	3,668	100%
Violations	2,090	94	126	6	2,216	100
Systems in violation	573	89	70	11	643	100
% systems in violation	–	19	–	11	–	18
Connecticut						
Number of systems	573	91%	59	9%	632	100%
Violations	140	91	14	9	154	100
Systems in violation	89	90	10	10	99	100
% systems in violation	–	16	–	17	–	16
Florida						
Number of systems	1,880	84%	367	16%	2,247	100%
Violations	3,785	89	448	11	4,233	100
Systems in violation	1,006	87	153	13	1,159	100
% systems in violation	–	54	–	42	–	52
Illinois						
Number of systems	1,510	79%	400	21%	1,910	100%
Violations	897	87	136	13	1,033	100
Systems in violation	400	82	90	18	490	100
% systems in violation	–	26	–	23	–	26
Maryland						
Number of systems	453	89%	55	11%	508	100%
Violations	205	94	12	6	217	100
Systems in violation	84	90	9	10	93	100
% systems in violation	–	19	–	16	–	18
New Jersey						
Number of systems	401	63%	238	37%	639	100%
Violations	307	65	163	35	470	100
Systems in violation	98	51	94	49	192	100
% systems in violation	–	24	–	39	–	30

TABLE 2-9 (continued)

State	Systems serving < 3,300 pop. Number	Systems serving < 3,300 pop. Percent	Systems serving > 3,300 pop. Number	Systems serving > 3,300 pop. Percent	Total Systems Number	Total Systems Percent
North Carolina						
Number of systems	2,753	93%	207	7%	2,960	100%
Violations	4,539	98	77	2	4,616	100
Systems in violation	815	97	21	3	836	100
% systems in violation	--	30	--	10	--	28
Ohio						
Number of systems	1,279	81%	296	19%	1,575	100%
Violations	702	83	146	17	848	100
Systems in violation	316	86	52	14	368	100
% systems in violation	--	25	--	18	--	23
Pennsylvania						
Number of systems	2,039	86%	324	14%	2,363	100%
Violations	10,311	92	873	8	11,184	100
Systems in violation	859	90	92	10	951	100
% systems in violation	--	42	--	28	--	40
Texas						
Number of systems	4,018	86%	651	14%	4,669	100%
Violations	1,193	85	206	15	1,399	100
Systems in violation	672	82	148	18	820	100
% systems in violation	--	17	--	23	--	18
Washington						
Number of systems	2,320	94%	160	6%	2,480	100%
Violations	2,826	95	151	5	2,977	100
Systems in violation	1,208	94	71	6	1,279	100
% systems in violation	--	52	--	44	--	52
United States						
Number of systems	51,290	87%	7,570	13%	58,860	100%
Violations	58,328	92	5,042	8%	63,370	100
Systems in violation	15,217	90	1,723	10	16,940	100
% systems in violation	--	30	--	23	--	29

Source: U.S. Environmental Protection Agency, *Federal Reporting Data System FRDS-II* (computer printouts dated 2/25/92 and 3/3/92). Percentages were calculated by the authors.

water industry, especially its small system members, will be challenged to new limits as utilities seek to improve their technical capability.

Financial Performance

Viability frequently is defined in financial terms, as the earlier discussion of bankruptcy would suggest. This is certainly understandable given the financial strain on the water supply industry, attributable not only to the Safe Drinking Water Act but also the need to upgrade the nation's water supply infrastructure. Some will assert that the water industry's financial condition is uniquely poor. As one water utility executive lamented, "Much of the regulated water utility industry is 'troubled' if we consider it in light of its earnings in relation to the earnings of other utilities or of alternative non-regulated investments."[13] Representatives of the industry frequently have asserted that authorized and realized returns on equity for water are lower than returns for the other regulated sectors (electric, gas, and telephone).[14] Evidence on this issue is mixed.[15] However, there is considerable evidence that within the water industry, small systems are more financially troubled than large systems. Like technical capability, in other words, size plays a critical role in determining financial viability.

Using EPA survey data for 1986, mean financial statistics for the water industry per 1,000 gallons of water produced are provided in table 2-10. Economies of scale clearly are apparent. Gross assets per 1,000 gallons produced (defined as gross plant and equipment divided by average daily production) are many times greater for small systems than for larger systems. The same holds for operating expenses. Revenues per 1,000 gallons produced are higher for smaller companies than larger companies, although the differences are not quite so dramatic. The result is that the difference between average revenues and average expenses for the smallest water utilities (serving populations under 500) is negative. Utility revenues are further eroded by debt service and taxes, both of which affect private systems to a greater degree than municipal systems. Making matters worse is the

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[13] William D. Holmes, "The Take Over of Troubled Water Companies," 371-76.

[14] Ibid.

[15] Fassil T. Fenikile, *Staff Report on Issues Related to Small Water Utilities* (San Francisco, CA: Public Utilities Commission, 1991).

TABLE 2-10

MEAN FINANCIAL STATISTICS BY WATER SYSTEM SIZE

System Size(a)	Gross Assets(b) $/gal./day	Operating Revenues(c) $/1,000 gal.	Operating Expenses(d) $/1,000 gal.	Operating Margin(e) Amount	Percent
25-100	$ 24.9	$198.2	$278.0	$ -79.8	40%
101-500	16.5	242.6	259.3	-16.7	7
501-1,000	8.4	184.1	163.5	+20.6	11
1,001-3,300	7.2	204.1	163.9	+40.2	20
3,301-10,000	4.6	149.5	140.7	+8.8	6
10,001-25,000	4.1	180.2	138.6	+41.6	23
25,001-50,000	2.4	113.8	82.6	+31.2	27
50,001-75,000	2.2	103.1	83.1	+20.0	19
75,001-100,000	3.2	108.7	107.7	+1.0	1
100,001-500,000	2.2	114.5	79.5	+35.0	31
500,001-1,000,000	2.0	112.7	68.1	+44.6	40
Over 1,000,000	1.8	82.0	50.9	+31.1	38
Total	$ 10.6	$196.2	$188.0	$ +8.2	4%

Source: Frederick W. Immerman, *Final Descriptive Summary: 1986 Survey of Community Water Systems* (Washington, DC: Office of Drinking Water, U.S. Environmental Protection Agency, 1987), 6. Includes data for privately-owned and publicly-owned systems.

(a) Population served (not connections).
(b) Defined as gross plant and equipment divided by average daily production.
(c) Defined as operating and maintenance expense, depreciation expense and other operating cost, per 1,000 gallons of water produced annually.
(d) Defined as revenues from all water sales per 1,000 gallons of water delivered annually.
(e) Calculated by authors. The amount is the difference between average revenues and average expenses; the percent is this difference divided by average revenues.

fact that some municipal systems enjoy revenues from sources other than water sales. Most private systems must somehow be sustained without cross-subsidization from another revenue source. State regulation, with its emphasis on cost-based ratemaking, helps ensure this as well.

These findings can be confirmed another way using the annual *Financial Summary for Investor Owned Water Utilities* published by the National Association of Water Companies (NAWC), which classifies water companies into seven size groups.[16] The smallest group in the NAWC database, class D companies (consisting of nine utilities with revenues under $50,000), reported average operating losses in 1990 of about $15,000. (In previous years even the larger class C companies reported losses.) Unfortunately, most of the 4,500 investor-owned water utilities as well as the 2,000 water districts, cooperatives, and homeowners' associations under commission jurisdiction fall in the class D category in terms of annual revenues. Many are presumed to be losing money and showing negative net worth, or accumulated losses, year after year.

In the 1991 NRRI survey, several state commissions reported that they had jurisdictional water systems with a negative net worth, negative net income, or both as reported in appendix A (table A-2). States with particularly severe situations are reported in table 2-11 in descending order according to systems with negative net income in two of the last three years. Topping the list are Florida, Texas, and Arizona, all of which have a substantial number of jurisdictional water utilities. Clearly, the problem of negative net income is pervasive. In many respects, however, systems with a negative worth are even more problematic because this measure is cumulative over time. Commission staff also were asked about the number of water utilities that ceased operations in 1990 for financial reasons (reported in table A-7 of appendix A). Leading this list, which totaled 48, was North Carolina (twenty systems), followed by South Carolina and Texas (six systems each), Pennsylvania (five systems), and Connecticut (three systems). These data, of course, do not reflect the financial distress of nonjurisdictional systems and systems that somehow escape state regulation.

Finally, for regulated utilities, another financial viability issue is the precarious existence of utilities with a negative rate base. This situation results

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[16] National Association of Water Companies, *1990 Financial Summary for Investor-Owned Water Utilities* (Washington, DC: National Association of Water Companies, 1991).

TABLE 2-11

ESTIMATED NUMBER OF SYSTEMS IN POOR FINANCIAL HEALTH
FOR SELECTED STATES, 1991

State	Approximate Number of Small Systems with: Negative Net Income (a)	Negative Net Worth (b)
✓ Florida	462	39
Texas	291	na
Arizona	226	91
Wisconsin	103	52
Montana	100	na
Kentucky	95	2
Pennsylvania	91	55
Indiana	90	90
Utah	60	15
Louisiana	58	58
Vermont	50	0
Mississippi	45	25
New Jersey	25	28
California	25	0
Illinois	22	9
Washington	21	9
South Carolina	na	23

Source: *1991 NRRI Survey on Commission Regulation of Water Systems* (see appendix A). Only water systems under the jurisdiction of the state public utility commissions are included. States with more than 20 systems in either category are included, with the ranking based on negative net income.

(a) Approximate number of small systems (under 3,300 population or 1,000 connections) having a negative net income (losses) in two of the last three years.
(b) Approximate number of small systems (under 3,300 population or 1,000 connections) having a negative net worth at the time of the survey.

from the relatively high proportion of contributed plant for many small water systems, which generally is excluded from the rate base in most jurisdictions. These systems do not benefit from depreciation as a source of revenues. Negative rate base can be "a critical issue for small water utilities."[17] It also sends a signal about financial viability.

Given these findings and observations, it is no wonder that financial viability of small water systems is a key concern to economic regulators, along with concerns about technical and managerial capability.

Managerial Performance

Earlier, economic growth was shown to be an essential requirement for the success of new small firms. A review of the banking literature also pointed out the critical importance of management in the success or failure of banks.[18] The Dun & Bradstreet failure data also indicate that management inexperience continues to be a major cause of business failure. As in the technical and financial areas, size is a factor in management too. For small firms, management competence and continuity are essential. A large firm can have an incompetent employee or two without jeopardizing the viability of the entire firm. When the one and only employee of a small firm is incompetent, the firm itself is in serious trouble.

The managerial structure of small systems often consists of an owner-operator. In many cases, real estate developers establish and initially operate small systems but often want to get out of the water business (which they never intended to enter in the first place) and move on to the next development within a few years. Other small system operators are landlords, as in the case of mobile home parks, providing water as an ancillary service to housing. If customer satisfaction is one measure of management capability, small systems seem to have more than their share of problems, as revealed in a study sponsored by the National

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17 Stephen B. Alcott, "Negative Rate Base in Water Co. and What to Do About It," a paper presented at the 1989 Annual Meeting of the Society of Depreciation Professionals in New Orleans, Louisiana (December 7, 1989).

18 Office of the Comptroller of the Currency, *Bank Failure*, Washington, DC: June 1988.

Association of Water Companies.[19] According to the study, customer of small water utilities:

- Gave their utilities lower scores on overall customer satisfaction compared with mid-sized and large firms.
- Gave their utilities lower scores on water quality than mid-sized and large companies.
- Were less pleased than average with their billing statements, finding them difficult to understand, inaccurate, and so on.
- Were least likely to feel that the cost of their water service was reasonable.

A paramount concern to drinking water regulators is the need for certified operators to help systems comply with increasingly complex treatment requirements. Based on EPA survey data, as reported in table 2-12, water systems employ both professional operators (who have formal training) and nonprofessional operators (who do not). Not surprisingly, the percentage of professional operators increases with system size. More professional operators work full time in almost every size category than their nonprofessional counterparts. Professional operators also are more likely to be certified, a trait that holds for all size categories. Finally, professional operators devote more hours each week to working at the system; the number of hours increases with system size. Professional, certified operators are likely to make a key difference in compliance with the Safe Drinking Water Act. As noted above, failure to meet monitoring and reporting requirements probably signals managerial as well as technical problems.

Utilities under the jurisdiction of state public utility commissions must comply with the requirements of economic regulation. Many small system managers are especially frustrated by the ratemaking process. In a few cases, systems have managed to avoid economic regulation even though they fall under a commission's jurisdiction. The Texas Water Commission, for example, has had to devote considerable attention to finding these renegade water systems. Utility managers are frustrated not only by the "red tape" of the regulatory process but also its

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[19] Walker Research: Customer Satisfaction Measurements, *Water Service Customer Satisfaction: A Management Report* (Washington, DC: National Association of Water Companies, 1988).

TABLE 2-12

WATER TREATMENT PLANT OPERATOR CHARACTERISTICS BY SIZE

System Size(a)	Percent Total Operators Prof.	Percent Total Operators Non.(b)	Percent Fulltime Prof.	Percent Fulltime Non.(b)	Percent Certified(c) Prof.	Percent Certified(c) Non.(b)	Hours worked per week Prof.	Hours worked per week Non.(b)
25-100	31%	69%	40%	4%	84%	11%	2	2
101-500	49	53	37	14	87	12	8	6
501-1,000	30	70	49	7	94	6	15	8
1,000-3,300	59	41	77	54	95	21	20	12
3,301-10,000	60	40	84	75	87	22	30	18
10,001-25,000	40	60	92	42	96	19	29	21
25,001-50,000	80	20	96	83	93	31	34	12
50,001-75,000	81	19	96	95	91	10	37	15
75,001-100,000	81	19	100	86	97	45	37	8
100,001-500,000	78	22	98	96	80	26	35	14
500,001-1,000,000	78	22	99	99	92	16	41	23
Over 1,000,000	65	35	99	100	84	32	34	17
Total	49%	51%	70%	30%	91%	14%	13	8

Source: Frederick W. Immerman, *Final Descriptive Summary: 1986 Survey of Community Water Systems* (Washington, DC: Office of Drinking Water, U.S. Environmental Protection Agency, 1987), 28. Includes data for privately-owned and publicly-owned systems.

(a) Population served (not connections).
(b) Prof. = professional operators who have formal training in water treatment plant operations. Non = nonprofessional operators who have no formal training.
(c) Operator certified by the state.

cost. Numerous anecdotes recount the situation where a substantial portion of the requested revenue requirement is needed simply to meet rate case expenses, such as accounting assistance and legal counsel.

Investor-owned utilities and others under the jurisdiction of the state public utility commissions generally are required to submit periodic reports for use in monitoring the health of individual utilities and the industry as a whole. Late or inadequate reports can trigger concern, as recently noted by members of the Ohio commission staff in their water and sewer newsletter:

> The majority of companies filed their reports on time in an accurate and complete manner. Unfortunately, there were several companies that did not return their annual reports by [the deadline]. . . . Missing a deadline as important as this, especially when it is missed in more than one year (as was the case with a couple of the companies), is an indication that there could be serious troubles in the management of the utility. In addition to stiff penalties which can be levied on delinquent filers, the PUCO has the authority to investigate the causes of the tardiness. It is hoped that, in the future, all companies will respond in a timely manner so that the inconvenience of this procedure can be avoided.[20]

This and other evidence might suggest that regulators today may be less tolerant of managerial incompetence. A 1988 order by the Connecticut Department of Utility Control found that the manager of one company had "shown an almost reckless attitude in his management of the Company. . . [failing] to provide the manpower and finances necessary to maintain services" and lacking an understanding of his obligation to serve.[21] In this case, among other directives by the DPUC, officers of the company were personally fined $750.

The relationships among the technical, financial, and managerial dimensions of viability are circular, which is why so many small water systems seemed trapped in a never-ending pattern of failure. Technical problems drain financial resources and frustrate managers. Financial crises make technical and managerial improvements impossible. Managerial weaknesses aggravate technical difficulties and present a

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20 *Water and Sewer Newsletter* (A publication of the Public Utilities Commission of Ohio) 4 no. 2 (November 1991): 12.

21 "Water Service and Supply," *NRRI Quarterly Bulletin* 9 no. 3 (July 1988): 355.

barrier to raising financial resources. Breaking this cycle should be the goal of any public policy intending to remedy "the small water systems problem."

CHAPTER 3

VIABILITY POLICIES FOR EMERGING WATER SYSTEMS

The key to assuring the viability of water systems is the judicious use of state regulatory authority so that only viable systems emerge in the first place. This authority rests in the hands of state drinking water regulators and, in the case of many small systems, state public utility commissions. Each has a certification process, a permitting process, or both whereby new systems emerge. The need to tighten up the certification and permitting processes and curtail the emergence of new nonviable water systems has been well recognized by the states. As mentioned already, many have taken significant steps in this area and have begun to see positive results in slowing the proliferation of new water systems. Any state now without a proliferation policy has several apparently successful working models from which to choose. Viability policies toward emerging water systems can be subdivided into the institutional dimensions identified in chapter 1 (regulatory, structural, and comprehensive).

Regulatory Policies

A strong consensus exists on the critical nature of certification in shaping the viability of the water supply industry. The certification process is the state's most important tool in screening systems before they actually begin operations. In the lexicon of economic regulators, certification can present a barrier to market entry. Ideally, regulatory approvals are garnished before significant investments are made, but this is not always the case. Sometimes the certification process is used to grant a monopoly franchise to systems already in existence. The methods for improving the viability of existing water systems are more difficult and costly to implement. Thus the importance of the certification process for assuring the viability of emerging water systems cannot be overstated.

Federal water regulators have emphasized the importance of the state certification or permitting processes in determining the technical, financial, and managerial viability of proposed systems as well as the assessment of structural alternatives to their creation:

> Establishing State viability programs to assess a small system's performance before construction are one step toward instituting a more functional, problem prevention approach to drinking water management. Several States already have effective viability measures. For example, the permitting process can be used to ensure the financial, managerial and technical qualifications of water system owners and operators by requiring comprehensive reviews of the systems. This process also can be used to determine whether proposed systems can be interconnected with existing systems or could be run better through satellite management.[1]

It would be misleading, of course, to say that nonproliferation can be accomplished without objection. State authorities may encounter some resistance to the curtailment of new water systems.[2] Property owners might object if they believe that limits on the creation of new water systems would restrict land development, thereby depriving them of the maximum use of their property. Others might view tighter state controls as an obstacle to the provision of safe drinking water to isolated rural communities. For some systems, there even might be an attempt to evade the state regulatory structure by using alternative ownership arrangements that would exempt them or by other means. So far, these potential forms of opposition have not proved to be significant. Thus in the design of nonproliferation policies, potential opposition should be recognized but not necessarily viewed as an insurmountable obstacle.

Despite federal interest in nonproliferation, it is a policy dependent almost entirely on implementation at the state and local levels. In most cases, water systems do not emerge without the approval of more than one regulatory agency. The multiplicity of regulatory approvals required at the state and local levels can thwart nonproliferation efforts. In Pennsylvania, for example, five regulatory mechanisms are at work:[3]

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[1] U.S. Environmental Protection Agency, *Developing Solutions: On the Road to Unraveling the Small Systems Dilemma* (Bulletin no. 1, July 1990), 1.

[2] U.S. Environmental Protection Agency, *Ensuring the Viability of New, Small Drinking Water Systems: A Study of State Programs* (Washington, DC: U.S. Environmental Protection Agency, 1989), vi.

[3] Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), 4-12.

- Local government authority under the Municipalities Planning Code.
- Department of Environmental Resources (DER) wastewater permit authority under the Pennsylvania Sewage Facilities Act.
- DER public water supply permit authority under the Pennsylvania Safe Drinking Water Act.
- DER water allocation permit authority under the Water Rights Act and the Interstate Compacts on the Delaware River Basin and the Susquehanna River Basin.
- Public Utility Commission certification and rate approval authority under the Pennsylvania Public Utilities Code.

The coexistence of these many processes can present a significant barrier to public policy toward water systems, a problem that can be addressed by an integrated planning approach.[4] In terms of the nonproliferation problem, this is especially important in coordinating local land use and state water resource policies. The two principal state agencies involved in certification, however, are the state drinking water authorities (often a department of health or environmental protection) and the state public utility commissions.

State Drinking Water Authorities

All community water systems, defined by the U.S. Environmental Protection Agency as those serving twenty-five or more customers, must acquire construction and operating permits from state drinking water quality regulators to help ensure their compliance with applicable federal and state standards. In Pennsylvania, the conventional construction permit process involves both the Department of Environment Resources and the Public Utility Commission and proceeds in the following steps:[5]

- Preliminary subdivision approval (with final subdivision approval contingent on DER and PUC approvals).

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[4] Janice A. Beecher and Patrick C. Mann, *Integrated Resource Planning for Water Utilities* (Columbus, OH: The National Regulatory Research Institute, 1991).

[5] Wade Miller, *State Initiatives*, 8-2.

- Predesign conference with DER Engineer.
- Submittal of DER permit application.
- DER review of application and decision.
- PUC certification decision.

Although the chief concern of drinking water regulators is public heath and technical compliance with federal and state drinking water standards, many of these agencies have become aware of the importance of financial and managerial resources in water system viability. In Massachusetts, the Department of Environmental Protection has established rules that reflect the "three-legged-stool" approach to water system viability:

> No person shall construct, substantially modify, or operate a public water system without the prior written approval of the Department. The Department will not grant such approval unless... The person(s) who will own and operate the system demonstrates to the Department's satisfaction it has the technical, managerial and financial resources to operate and maintain the system in a reliable manner and provide continuous adequate service to consumers.[6]

Similarly, recent legislation in Montana gives the Department of Health and Environmental Sciences (DHES) authority to review the financial viability of new or expanding water systems in an effort to curb proliferation of new nonviable systems.[7] For drinking water regulators, this type of authority goes beyond the traditional regulatory roles.

Results of a survey of state drinking water agency administrators in the mid-1980s on procedures used to control small water system proliferation appears in table 3-1. Most had no such procedures in place at the time of the survey. While only nine state agencies reported they could prohibit construction, twenty-five reported they could discourage it. Similarly, few of these state agencies appeared to have authority to attach certain financial requirements (such as the creation of

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6 *310 CMR* (Massachusetts), Section 22.04.

7 Ibid., 3.

TABLE 3-1

PROCEDURES USED BY STATE DRINKING WATER AGENCY ADMINISTRATORS TO CONTROL SMALL WATER SYSTEM PROLIFERATION

	Yes	No	Percent Yes
None	11	30	22%
Are there specific enabling or restraining laws, regulations and/or policies?	9	32	22
In review of new systems, when extensions from another system are economically feasible,			
· Can you prohibit construction?	9	32	22
· If yes, do you?	7	2	78
· If no, do you discourage construction?	25	7	78
When extensions are not economically feasible, do you require:			
· Operation under contract with a viable entity?	6	30	17
· An operation and maintenance (O&M) plan?	10	26	28
· An escrow fund?	1	35	3
· A sinking fund?	1	35	3
· O&M funds until self-sustaining?	2	34	6
Do you require that small systems review and evaluate regionalization, consolidation, contract service or other alternative prior to a permit?	15	22	41
Do you require local planning of water systems?	11	26	30
Do you make non-proliferation a condition for grants and loans?	6	31	16

Source: Survey of State Drinking Water Administrators in 1984/1985 as reported in Robert G. McCall, *Institutional Alternatives for Small Water Systems* (Denver, CO: American Water Works Association, 1986), appendix B2. For each question, the data reflect 36 to 41 states reporting.

an escrow or sinking fund) to the creation of a new system. More activity was registered in the area of planning, with eleven agencies reporting they require local planning of water systems. Finally, fifteen state drinking water administrators reported that they required small systems to review and evaluate regionalization, consolidation, contract service, or other alternatives prior to getting a permit.

The authority of the state drinking water agencies to control the emergence of water systems is shared with their sister agencies, the state public utility commissions, although commission jurisdiction does not exist in every state or extend to as many types of water systems. Today, evidence from several states would suggest that the role of both agencies in implementing nonproliferation policies may be expanding.

State Public Utility Commissions

The blame for the proliferation of nonviable small water systems (usually privately owned) has often been laid at the door of the state public utility commissions: "The state PUC regulatory process has been too lenient in allowing the creation of many small water systems that were not financially viable when initiated."[8] In the past, commissions may not have presented an effective barrier to market entry for some utilities.

With a few exceptions, systems falling under the jurisdiction of the state public utility commissions must acquire a certificate of convenience and necessity, or its variant, for the purpose of entering a market, expanding service, or building new facilities.[9] These certificates are fundamental to the economic regulation of public utilities because of their monopolistic character and the state's responsibility

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[8] G. Wade Miller, John E. Cromwell III, and Frederick A. Marrocco, "The Role of the States in Solving the Small System Dilemma," *Journal of the American Water Works Association* (August 1988): 33.

[9] Only the commissions in Iowa, Oklahoma, and Oregon reported that they had no certification authority. On jurisdictional issues, see also Janice A. Beecher and Ann P. Laubach, *1989 Survey on State Commission Regulation of Water and Sewer Systems* (Columbus, OH: The National Regulatory Research Institute, 1989).

for assuring that they operate in the public interest.[10] Often in conjunction with certification, the commissions make determinations about viability in terms of a utility's capacity to meet its "obligation to serve." Most of the state commissions regulating investor-owned water utilities issue certificates of need and also have the authority to modify or revoke them. Some commissions are increasingly inclined to place restrictions or limitations on the certificates they do grant, such as requiring new systems to post a performance bond. This strategy requires a commission to use other oversight and enforcement tools, such as rate cases or financial audits, to review the condition of the firm at some future date.

The 1991 NRRI survey found that most of the state commissions with water system certification authority consider viability in the process, as reported in table 3-2.[11] Most also coordinate certification with drinking water regulators, who in some cases may have more authority in this area. Eighteen states have strengthened certification to help ensure viability; in others this process was underway at the time of this study. Only eight commissions reported denying certificates on the basis of the viability issue. More can be expected to follow as the curtailment of new systems through the certification process becomes a more prevalent public policy.

Commission staff members in twenty-seven states reported that they regarded their certification programs as adequate for ensuring the viability of small water systems. Staff in twelve states found their policies less than adequate in some respect. A few felt it was too early to evaluate their certification process because changes recently had been implemented. One of the key issues raised by commission staff is the need to conduct the certification process during an advance planning phase that takes place *prior* to the investment of capital. In some cases, construction is completed before commission approval is secured; state laws and regulations designed mainly to enfranchise utilities may not be sufficient for preventing this situation. In other cases, existing systems that rightly require certificates are "discovered." Once investments are made and expectations about

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[10] On the rationale for regulation, see Raymond W. Lawton and Vivian Witkind Davis, *Commission Regulation of Small Water Utilities: Some Issues and Solutions* (Columbus, OH: The National Regulatory Research Institute, 1983), 89.

[11] Only three of the forty-five commissions that regulate investor-owned water utilities reported that they had no certification authority. For some states, this authority is shared between the commissions and drinking water agencies.

TABLE 3-2

STATE CONSIDERATION OF WATER SYSTEM VIABILITY

Commissions that consider viability in the certification process	Commissions that coordinate certification with state drinking water authority	Commissions that have strengthened certification to help ensure viability	Commissions that have denied certificates on the basis of the viability issue
Alabama	Alabama	Arizona	Arizona
Arizona	Arizona	California	California
Arkansas	California	Connecticut	Connecticut
California	Connecticut	Delaware	Florida
Colorado	Delaware	Florida	New Jersey
Connecticut	Florida	Idaho	Virginia
Delaware	Hawaii	Maryland	West Virginia
Florida	Idaho	Nevada	Wyoming
Hawaii	Illinois	New Hampshire	
Idaho	Iowa	North Carolina	
Illinois	Kentucky	Rhode Island	
Kansas	Louisiana	South Carolina	
Kentucky	Kentucky	Tennessee	
Maine	Maryland	Texas	
Maryland	Michigan	Utah	
Michigan	Mississippi	Vermont	
Mississippi	Missouri	Virginia	
Missouri	New Hampshire	Wyoming	
New Hampshire	New Jersey		
New Jersey	New Mexico		
New Mexico	New York		
New York	North Carolina		
North Carolina	Ohio		
Ohio	Pennsylvania		
Pennsylvania	South Carolina		
Rhode Island	Tennessee		
South Carolina	Texas		
Tennessee	Utah		
Texas	Vermont		
Utah	Virginia		
Vermont	West Virginia		
Virginia	Wisconsin		
West Virginia	Wyoming		
Wisconsin			
Wyoming			

Source: *1991 NRRI Survey on Commission Regulation of Water Systems.*

water service are raised, political and economic pressures can make it difficult for commissions to deny a certificate of necessity.

Commission Certification Policies

Commission certification policies can be distinguished according to four different types of regulatory authority: statutes, rules, resolutions and other statements of policy, and company-specific commission orders. Selected examples are provided here to illustrate the fairly substantial array of commission policies available for controlling the emergence of nonviable water systems. States most effective in their nonproliferation policies generally have reinforcing policies based on different levels of regulatory authority.

Statutory authority can be an essential part of a state's nonproliferation policy, even if it only serves as a disincentive for creating new systems. Texas statutes, revised in 1991 to include consideration of the utility's debt-equity ratio in the certification process, reflect the growing commitment on the part of state legislatures in giving regulators they tools needed to make the certification process more effective:

> Certificates of convenience and necessity shall be granted on a nondiscriminatory basis after consideration by the commission of the adequacy of service currently provided to the requested area, the need for additional service in the requested area, the effect of the granting of a certificate on the recipient of the certificate and on any retail public utility of the same kind already serving the proximate area, the ability of the applicant to provide adequate service, the feasibility of obtaining service from an adjacent retail public utility, the financial stability of the applicant, including, if applicable, the adequacy of the applicant's debt-equity ratio, environmental integrity, and the probable improvement of service or lowering of cost to consumers in that area resulting from the granting of the certificate.[12]

In addition to statutory authority, most commissions develop their own rules for implementing the certification process on their own or pursuant to the enactment of a new statute. The rulemaking process presents an opportunity to consider the relationship between certification and viability. For example, the Idaho Public Utilities Commission initiated a Notice of Intended Rulemaking in 1980

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[12] Texas Statutes, Section 13.246.

to consider its certification policies for Class D water utilities (those with less than $50,000 annual gross water revenues from water operations). The commission adopted an order in the case in 1987. The questions raised, recommendations made, and resultant rules are presented in table 3-3.

Portions of the rules imposed by three state commissions (Connecticut, Florida, and Ohio) are reported in appendix B of this report. Certification rules can serve to screen applicants (discouraging some from applying in the first place) as well as to force them to consider and plan for the substantial responsibilities associated with establishing a water system. The language of the highly detailed Connecticut rule, which applies not only to the Department of Public Utility Control but the Department of Health Services, expressly refers to the "proliferation" problem:

> These Regulations are intended to restrict the proliferation of new small water systems, to promote good public utility practices, to encourage efficiency and economy, to deliver potable water in accordance with applicable health standards, and to establish minimum standards to be hereafter observed in the design, construction and operation of waterworks facilities of new small water systems and on which existing community water systems should base their future plans should they choose to expand. The Certificate of Public Convenience and Necessity assures town governments that community water systems will operate in accordance with the general requirements and applicable minimum standards of. . . . the Regulations of Connecticut State Agencies.[13]

In Ohio only a few new water system certificates have been issued over the past several years despite fairly rapid growth in some areas. The Ohio certification rules are similar to those in several states and require "unobligated paid-in capital" equal to 40 percent of the construction of new facilities and commitments from financial institutions for the remaining funds. Applicants must file with the commission a statement from the Ohio Environmental Protection Agency (OEPA) stating that the OEPA has approved preliminary plans for the proposed system and that it would approve final plans after the commission grants a certificate of convenience and necessity. A pro forma income statement for the first and fifth years of operation must also be filed with the certificate application. The staff of the Ohio Public Utilities Commission carefully reviews pro forma projections and reports its findings to the Commission. The Ohio rules effectively address many

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13 *Rules of the Department of Public Utility Control, Section 16-292m-9* (see appendix B).

TABLE 3-3

IDAHO'S RULEMAKING ON SMALL WATER UTILITY CERTIFICATION

Questions in the Notice of Proposed Rulemaking

1. Should the Commission deny a certificate for an operation that is likely to be unviable or to provide inadequate service?

2. Should the Commission deny a certificate for a potentially viable system if another entity is demonstrably able to serve the proposed area adequately?

3. Should the Commission promote conversion of unviable or marginal water utilities to public ownership or mergers with more viable entities when those opportunities arise and customer services are likely to improve as a result?

4. Assuming that the Commission should grant certificates only to viable water systems, what criteria of viability should it employ? In particular, is a water system viable if it cannot earn its owner a fair rate of return on an investment without combining funds with nonwater operations or without charging rates that are unreasonably high compared to similar utilities?

5. Should the Commission consider encouraging developers to contribute the cost as a part of the cost of the water system in determining whether or not the water system should be viable?

6. Should the Commission require developer applicants to substantiate that they have not recovered any part of the cost of the water system through the sale of the lots?

Recommendations Made to the Commission

1. The Commission should deny certificates for water companies that are likely to be nonviable, to be marginally viable, or to provide inadequate service.

2. The Commission should deny certificates to potentially viable systems if a stronger or more reliable utility is able to serve the area.

3. The Commission should cancel certificates for water companies if the certificates remain unexercised.

4. The Commission should support and promote conversion of nonviable or marginally viable water companies to public ownership or merger with viable utilities.

TABLE 3-3 (continued)

5. The Commission should grant certificates for proposed new water companies only when it is demonstrated (a) that there is a need for a water company and no other water company is willing to serve the area, and (b) that the proposed water company proves its reliability by showing that its proposed revenues from reasonable rates will give it a reasonable opportunity to earn a fair return on its investment without subsidization from other businesses or other sources of income.

6. The Commission should establish a presumption that all capital investment in a developer-created system is contributed capital.

7. The Commission should coordinate with State or Health District water quality regulators by regular review of all investor-owned water systems brought to the attention of State or District Health officials.

Rules and Regulations Adopted by the Commission

1. *Small Water Companies Defined.* Small water companies are water corporations as defined by the Public Utilities Act that (a) have or anticipate not more than $50,000 annual gross revenues from water operations, or (b) provide service to fewer than three hundred customers or proposed initially to provide service

2. *Alternative Service and Consideration.* The Commission may deny certificates for proposed new small water companies when it is demonstrated that there is no need for the service or that another company (whether municipal, cooperative or investor-owned) is wiling and able to provide similar or better service.

3. *Presumption of Contributed Capital.* In issuing certificates for a small water company or in setting rates for a small water company, it will be presumed that the capital investment in plant associated with the system is contributed capital, i.e., that this capital investment will be excluded from rate base.

Source: Idaho Public Utilities Commission, *In the Matter of Rulemaking for Class D Water Companies,* Order No. 21208 dated April 30, 1987.

viability issues, especially the need for advance regulatory approvals and adequate financing. Also, while not especially rigorous, the rules may be a discouragement to new water company applicants.[14]

Some commissions have passed resolutions or other policy statements concerning nonproliferation. Somewhat ahead of its time, California adopted a small water system viability policy in 1978 with Resolution M-4178, which appears in table 3-4.[15] The number of jurisdictional water utilities in the state declined from more than 323 at the inception of the policy to 223 by 1990. According to a Commission staff report, the resolution constituted a "restrictive" policy toward small water utilities and calls for the denial of certificates that are likely to result in a nonviable or marginally viable utility or when another public or private entity is able to serve the proposed area.[16]

Simultaneously with or soon after the certification of a new water system, most commissions review and approve an initial rate structure, which itself is a key determinant of water system viability. In the late 1970s, also ahead of its time, New York implemented an "initial rate policy" dealing directly with the problem of real estate developers who initially charge customers an artificially low rate during development only to shock them later with greatly increased water rates based on full return on fully capitalized plant after developments had been completed.[17] The policy emphasizes that this practice leads customers to believe that at least some of the construction costs of the water system had been recovered in the sale price of the homes. To make matters worse, when the cost of the water plant is placed in the utility's rate base it allows for double recovery. In this case, the commission would be inclined to reduce or eliminate the proposed rate base to keep rates in

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14 The best source of information about how discouraging they are would come from developers. A survey of major developers would be a useful next step in developing nonproliferation policies.

15 Fassil T. Fenikile, *Staff Report on Issues Related to Small Water Utilities* (San Francisco: Public Utilities Commission, 1991), 13.

16 Ibid.

17 Memo of the Water Division to the New York Department of Public Service regarding Case 90-W-0482, Initial Tariff Filing by Warwick Water Corporation (September 7, 1990).

TABLE 3-4
CALIFORNIA COMMISSION'S POLICY STATEMENT ON SMALL SYSTEM VIABILITY

SUBJECT: Resolution for Commission Adoption on Certification Policy for Water Companies and Support or Mergers of Small Water Companies or their Conversion to Public Status.

WHEREAS: The Commission finds that Class D water company operations tend to be inadequate for both owners and customers. The lack of economies of scale often results in a limited return on the owner's investment and poor service to the customer. Now, therefore, be it resolved that the Commission will:

(a) deny certificates for operations which are likely to be unviable or marginally viable or provide inadequate service, whether or not an existing entity can provide service to the subject area;

(b) deny certificates for a potentially viable system if another entity, such as a public utility or public district, is able to serve the proposed area;

(c) cancel unexercised certificates for operations unlikely to be viable systems if developed; likewise cancel certificates for constructed systems serving no customers when the owner requests a transfer and sale of the utility which would not be likely to result in a viable operation;

(d) support and promote the conversion of unviable or marginal water utilities to public ownership or their mergers with more viable entities when opportunities arise and customer service is more likely to improve through such change than without it;

(e) grant certifications for proposed water systems only when (1) need for the utility is demonstrated by applicant showing that no other entity is willing and able to serve the development and concrete present and/or future customer demand exists and (2) viability is demonstrated, ordinarily through the following tests:

- proposed revenues would be generated at a rate level not exceeding that charged for comparable service by other water purveyors in the general area;

- the utility would be self-sufficient, i.e., expenses would be supported without their being allocated between the proposed utility and other businesses;

- the applicant would have a reasonable opportunity to derive a fair return on its investment, comparable to what other water utilities are currently being granted.

Source: Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), 3-13.

line with what customers were used to paying and preclude the possibility of double recovery. This initial rate policy has the force of law behind it:

> In 1977, Section 89-e(2) of the Public Service Law was amended to require that all waterworks file a tariff containing rates and rules for water service 120 days prior to providing service. This amendment allows staff and the Commission to determine what plant cost will be included in and recovered through rate base, before the customers are served.
>
> Because a water company with no rate base may eventually provide deteriorating water service (a water utility without rate base has no means of earning a profit, and there is no incentive to continue operation as a viable business), the Commission began requiring developers to capitalize a portion of the water plant construction costs, and to charge initial rate which reflected that rate base, so there would be a profit and incentive to operate the system once real estate sales ceased. The currently used minimum capitalization is $1,500 per customer.[18]

Although this particular policy may only be part of the state's overall nonproliferation strategy, the strategy seems to be working. The number of jurisdictional water utilities in New York declined steadily through the 1980s.

Commission policy can be developed not only through statutes and rules but on a case-by-case basis. Some commissions have begun to require new water systems to create an escrow account or post a performance bond as a condition of certification to protect the public should the systems fail within a specified amount of time. This requirement can be an effective screening device because it is likely to deter the development of water systems whose viability is uncertain. When viability is not an issue, the bond itself should not pose a barrier to the creation of a needed water system. The bond is no longer required when self-sufficiency is established and demonstrated to the satisfaction of regulators. A certification order issued by the Arizona Corporation Commission illustrates some of the mechanics involved in issuing a performance bond:

> [The] approval of [the water system's] application for a Certificate of Convenience and Necessity shall be expressly contingent upon [the water system] posting a form of performance bond in the amount of $3,000 (cash deposit, surety bond, or similar alternative, i.e., certificate of deposit) with the Commission to ensure that Applicant shall meet its obligations arising under its Certificate; in the event Applicant chooses to make a cash deposit, said amount shall be deposited with a federally

18 Ibid.

insured financial institution and bear interest at a commercial acceptable rate until [the water system] achieves viable operations, is sold to another company, or ten years have passed, whichever is sooner, at which time the bond will be returned to [the water system], upon approval of its application for same.[19]

Finally, for the certification process to be effective, regulators must be prepared to reject certificates for systems that cannot meet viability standards. A recent order issued by the Florida Public Service Commission rejecting a certificate recognizes the fact that new water systems face substantial cost pressures under federal drinking water standards and that small size is a distinct disadvantage to their viability:

> We are concerned about [the company's] ability to operate the water system. It is unlikely that a system of this size will be able to operate as a financially sound business, especially when the requirements of the Safe Drinking Water Act are fully implemented. It is anticipated that the cost of providing water service which complies with these requirements will have a greater impact on a small utility [than] on a larger utility which can spread the cost over a larger number of customers.[20]

Outright rejection of a certification of convenience and necessity, which at least eight commissions have done (table 3-2), forces consideration of structural alternatives to the creation of a new water system.

Structural Policies

Structural policies are an intrinsic part of regulatory policies toward emerging water systems because the certification process often places a burden on applicants to show that structural alternatives for providing community water service are unavailable. Structural options can have a substantial and complex effect involving

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19 Arizona Corporation Commission, *In the Matter of the Application of Golden Corridor Water Company for a Certificate of Convenience and Necessity to Operate a Water Utility in Portions of Pinal County, Arizona* (Docket No. u-2497-87-107, Decision No. 56088, August 17, 1988).

20 Florida Public Service Commission, *In re: Application of Pointe Utilities, Inc. for Water Certificate in Marion County* (Docket No. 900152-WU, Order No. 22976, May 24, 1990).

the creation or reorganization of existing management or political entities providing water service.[21] They typically present opportunities for improving economies of scale and scope in the provision of a service. Structural options exist for the creation of new systems while restructuring options are available for existing systems. As discussed in the next chapter, structural alternatives for existing systems also include such methods as satellite management and mergers.

Two key structural dimensions are size and ownership. On the issue of size, because of economies of scale (as noted in the Florida Commission order cited above and in chapter 2), there is considerable consensus that larger is better than smaller. For this reason, regulators responsible for certification almost always ask whether, as an alternative to the creation of a new water system, service can be provided by an existing nearby water utility. Many regulators, either from a public health or public utility standpoint, seem to feel so strongly about the size issue that they are essentially indifferent about ownership (except to the extent it may affect whether a utility falls within a commission's jurisdiction). Most regulators seem to have a strong preference for the *extension* of existing water service into new areas as compared with the *creation* of a new and potentially nonviable small water system.

The perennial debate over public versus private ownership will not be replicated here; there is no clear consensus on appropriate ownership structure among regulators or anyone else. In fact, it can be argued that the answer depends heavily on local political and economic circumstances as well as the characteristics of the utility service in question. Traditionally, a key advantage of municipalities has been their access to the capital necessary for improving utility infrastructures. However, the growing pressures on local government finances and the growing interest in developing private sources of capital may blunt the public-ownership advantage.[22] Large private systems, in fact, may play an essential role in the future structure of the water supply industry. Furthermore, some degree of "competition" among public and private water utilities may eventually prove to be beneficial to the industry as a whole.

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21 Adapted from SMC Martin, Inc., *Regionalization Options*, III-1.

22 Even in the wake of the 1986 tax code amendments, both public and private water utilities have some access to tax-exempt bonds, but volume limits are imposed on the states.

The interest in exploring public ownership of water systems is understandable given the predominance of private ownership of the smallest water utilities and the concern that viability may be linked to ownership structure. In particular, small water systems of an ancillary nature (such as those associated with mobile home parks) or the owner-operator variety (serving only a handful of customers) have drawn considerable fire. In many of these investor-owned systems there is only one investor whose only available capital for the firm is personal capital. Within the public ownership form, which can be loosely defined in terms of noninvestor-owned systems, there remain many specific alternatives.[23] On a smaller scale, there are associations or nonprofit water supply corporations (which actually are quasipublic entities), local special districts, and areawide special districts or authorities. On a larger scale, there are water districts, county-owned utilities, and even state-owned utilities. Many proposed regionalization policies depend on having the weight of government behind them, making implementation through public ownership easier.

Ownership, however, does not consistently define whether a system falls under the jurisdiction of the state public utility commissions. As noted in chapter 1, forty-five state commissions regulate investor-owned systems but in addition some have authority over municipal systems (fourteen commissions), water districts (nine commissions), cooperatives (thirteen commissions), and homeowners' associations (nine commissions).[24] In addition, in selected states commission authority extends to regional authorities (Connecticut), conservancy districts (Indiana), water associations (Kentucky), not-for-profit systems (Ohio), and miscellaneous political subdivisions (Texas).[25] In general, commission jurisdiction over publicly owned water systems is more limited than jurisdiction over investor-owned systems.

The many variations in commission oversight across the states should not pose a barrier to the consideration of structural alternatives. However, it is noteworthy that within states, the structure of a proposed water system will determine the nature of commission jurisdiction. It is possible to circumvent the public utility

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23 SMC Martin, Inc., *Regionalization Options;* and McCall, *Institutional Alternatives.* See appendix E.

24 Janice A. Beecher and Ann P. Laubach, *1989 Survey on State Commission Regulation of Water and Sewer Systems* (Columbus, OH: The National Regulatory Research Institute, 1989).

25 Ibid.

regulatory process by establishing a water system that does not fall under state commission jurisdiction. Those in favor of commission oversight will favor structures that make it possible; those opposed will not.

As seen above, many commission rules and state statutes specifically require the consideration of alternative ways to provide water service prior to certification (see table 3-3). Ohio, for example, requires that a new water utility applicant show that "no existing agency, publicly or privately owned or operated, would or could economically and efficiently provide the facilities and services needed by the public in the area which is the subject of the application."[26]

In 1991 Nevada adopted some very significant legislation to assure the continued provision of water service should a new water system fail (see appendix C).[27] Permitting authority belongs to the Division of Health, which in the permitting process requests comments from the owner of the system, the local government within whose jurisdiction the system will operate, the state engineer, and the public service commission. Proposed privately owned water systems will be issued a special permit if they can demonstrate that there are no alternative to their creation (such as the extension of service by nearby systems). As a condition of the permit, system owners must post a five-year performance bond not with the state but with the local governing body (such as the city council or county commission) of the jurisdiction in which they plan to operate because this governing body is to have the ultimate responsibility for water service should the system fail. The draft rules for the legislation spell out the requirements:

> (h) The health division may not issue an operating permit until the local governing body submits written documentation which assures that it will:
>
> 1) assume responsibility for the water system's continued operation and maintenance in accordance with the permit's terms and conditions; and

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26 *Ohio Administrative Code*, Ch. 4901:1-15-03, C (2).

27 *Small System Viability Bulletin* (A publication of the Office of Ground Water and Drinking Water, U.S. Environmental Protection Agency) no. 6 (August 1991): 2.

2) assume the duty of assessing lands to be served by the water system for its proportionate share of the cost of the continued operation and maintenance in the event of a default by the applicant or operator of the water system and a sufficient surety is unavailable.[28]

This approach could be used by the state public utility commissions as well. A certificate of convenience and necessity could be made contingent on the provision of assurances that a local governing body (or possibly a nearby utility) would fulfill the "obligation to serve" should a new system fail. A performance bond could be posted with the entity assuming this responsibility. Certainly local governments would be forced to consider carefully their policies toward development. The use of such contingencies may require new statutory authorities, but the potential benefits are substantial.

Many contemporary state policies reflect the idea that the establishment of a new water system essentially is a last resort. The rules of the Connecticut Department of Public Utility Control make this point:

> If the Department of Public Utility Control and Department of Health Services determined that a main extension is not feasible or no utility is willing to extend such main, and that no existing regulated public service or municipal utility or regional water authority is willing to own, operate and maintain the final constructed water supply facilities as a non-connected, satellite system, and if it is not feasible to install private individual wells, the applicant may continue forward with the application by satisfactorily providing the following additional information. . . .[29]

While public policies can force consideration of structural alternatives, cases where there are no feasible structural alternatives will remain. In such cases, regulators with certification authority need not feel compelled to issue a certificate to a potentially nonviable system. In California, the Commission resolved to "deny certificates for a potentially viable system if another entity, such as a public utility or public district, is able to serve the proposed area" but also resolved to "deny

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28 "Operating Permits for Newly Constructed Privately Owned Public Water Systems," Division of Health, Bureau of Health Services Protection Services, Carcon city, NEvada (Draft dated May 27, 1992), 5.

29 *Rules of the Department of Public Utility Control, Section 16-292m-9* (see appendix B).

certificates for operations which are likely to be unviable or marginally viable or provide inadequate service, whether or not an existing entity can provide service to the subject area" (see table 3-4). In other words, the absence of a structural alternative *does not*, according to the Commission, justify the establishment of a nonviable water system.

No community water service, it seems, is preferable to service by a nonviable entity. This is a difficult but probably necessary exercise of commission regulatory authority. In California and elsewhere, it is a policy proven to be effective. In cases where commissions do not allow the establishment of a new water system, the best hope for providing community water service to the area in the long term may be through the use of a more comprehensive approach.

Comprehensive Policies

Comprehensive policies toward emerging water systems emphasize better coordination among regulatory agencies, long-term structural solutions, and above all, integrated resource planning.[30] In this case, integrated planning is not of the least-cost variety that can be conducted by larger public utilities, but of the type that must be initiated by the state government and designed to encompass the small water systems under its jurisdiction. It is a paradigm that is still in its infancy in the water sector.

Historically, the interrelationships between water and land-use planning have been inadequately addressed, in large part due to organizational conflicts between federal water resource development and management on the one hand and local land-use planning on the other.[31] The emergence of small systems in the first place frequently is associated with real estate development. Moreover, flooding, urban runoff, and water supply adequacy are among the issues that can be jointly addressed in a more integrated process.

Particularly in arid climates, better planning also can promote ways to limit future water needs, such as reduced lot sizes, water-efficient plumbing codes, and

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30 Janice A. Beecher, James R. Landers, and Patrick C. Mann, *Integrated Resource Planning for Water Utilities* (Columbus, OH: The National Regulatory Research Institute, 1991).

31 American Society of Civil Engineers, *Urban Planning Guide* (New York: American Society for Civil Engineers, 1986), 308.

water-efficient landscaping (xeriscape) practices. Unfortunately, water supply adequacy has not always been recognized as a critical land-use planning factor:

> In many growth areas, development has been allowed to take place with little regard for the availability of services, including water supply. In the Charlotte Harbor area of southwest Florida, for example, land was platted for subdivisions which could add 2,000,000 people. The water supply requirements to accommodate such a population would be eight times greater than current consumption, and would have to be met through new storage capacity. Similarly, many rapidly growing areas of Texas, Arizona, and California have allowed land development with little regard for available water resources.[32]

Integrated resource planning can help alleviate the proliferation of nonviable small water systems by shifting the emphasis of utility planning and making it more comprehensive in scope. A former director of the now-defunct U.S. Water Resources Council observed this need over a decade ago:

> Water planning has to be revitalized by recognizing the interrelationships between land use and water use; a new basis has to be found for water planning. In the past, water planning has tended to be based on projected economic and population trends. Water resources planners have tended to use projections of population and economic activity. . . . as synonymous with public goals. As a result, planning decisions have tended to focus on when, where, and how a project can be built to meet future needs. Projections have become self-fulfilling prophecies.
>
> Such planning may have been appropriate in the past. . . . However, water planner must now consider. . . . an expanded set of issues. . . . Planning should become a positive force for desirable change rather than a reaction to uncontrolled growth.[33]

For planning to help resolve the small systems problem, several institutional mechanisms may be required. To be effective, integrated planning of this nature may require new legislative authorities as well as a redefinition of state and local agency roles and responsibilities. As certifiers of new investor-owned (and other) water utilities, the state drinking water administrators and the state public utility commissions can provide critical checkpoints to assure that new systems will not

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32 Ibid.

33 Warren D. Fairchild as quoted in William R. Smith, "Regional Allocation of Water Resources." *American Water Works Association Journal* 73 (May 1981): 229.

emerge if doing so is not in the public interest. To make this determination, however, these agencies need to coordinate their efforts as well as be aware of state water resource and land use planning mandates governed by other agencies. Local governments, too, must help assure that the establishment of new water systems comports with planned development and land use. Agencies with certification authority may need to find ways of integrating these planning considerations into regulatory proceedings (that is, making them part of the evidentiary records on which decisions are made).

Mechanisms are emerging that facilitate more comprehensive approaches. Some commissions may find rulemakings and generic proceedings appropriate for developing integrated policies. Another approach is the development of memoranda of understanding among state agencies responsible for water utility certification and regulation. Memoranda of understanding already are in place in California, under development, in Flordia, and under consideration in Pennsylvania and elsewhere. These agreements can help spell out agency roles and responsibilities and provide methods for coordination. A more coordinated regulatory process will help prevent some new water systems from falling through the regulatory cracks (as occurred with greater frequency in Texas prior to the creation of the Water Commission).

Highlights of three comprehensive state viability policies, all of which emphasize planning, are provided in table 3-5. Connecticut's process emphasizes interagency cooperation and planning as well as planning by individual water systems. At the state level, Maryland also emphasizes nonproliferation and planning. Regional authorities in Maryland, such as the Governor's Commission on Growth in the Chesapeake Bay Region, reinforce the idea of planned growth.[34] Another leading example, after which other state programs are being modeled, comes from Washington state, where recently adopted planning legislation calls for "improved coordination between states agencies engaged in water system planning and public health regulation and local governments responsible for land use planning and public health and safety."[35] The statute further provides for the strengthening of existing planning procedures and processes and inclusion of small systems.

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[34] Governor's Commission on Growth in the Chesapeake Bay Region, *Protecting the Future: A Vision for Maryland* (Baltimore, MD: Maryland Office of Planning, January 1991).

[35] State of Washington, *Substitute Senate Bill No. 6446* (signed into law March 21, 190).

TABLE 3-5

HIGHLIGHTS OF THREE COMPREHENSIVE STATE VIABILITY POLICIES

Connecticut

- The state's comprehensive program consists of three new state authorities: (1) a comprehensive water supply planning mandate, modeled after the Washington program; (2) a joint certification process for new systems, administered jointly by the Department of Health Services (DOHS), the Safe Drinking Water Act (SDWA) primacy agency, and the Department of Public Utility Control; and (3) a takeover law, jointly administered by the DOHS and DPUC.

- Individual water system plans are required for systems within a planning area serving more than 1,000 customers. An areawide supplement defines service area boundaries for the region, defines plans for providing new service, and provides an assessment of the potential for regionalization strategies.

- The joint DOHS and DPUC certification process for new systems provides the state with extensive authority to control new system formation and state officials report success in reducing the growth of new systems. Certification authority extends to all new systems regardless of ownership.

Maryland

- Strong controls on small system formation and operation are based on a tradition of strong county government, a concentrated pattern of urban and suburban development that lends itself to regionalization, and visionary legislation.

- Counties must develop comprehensive water supply plans that specify service areas, needs for new service over the next ten years, and how any proposed new water systems will be financed. Planning grants are available to counties.

- The Maryland Department of Environment (MDE) has the authority to require evidence of viability from proposed new system developers including financial, managerial, and technical data it deems relevant.

- The MDE has the authority to compel operation of existing systems in a manner that will protect public health.

- Municipalities have authority to take over failed private systems by condemnation or by agreement.

TABLE 3-5 (continued)

Washington

- Under the Public Water System Coordination Act (1977) coordinated water system plans are to be developed for critical water supply service areas to be defined throughout the state.

- The planning process proceeds in three steps: (1) a preliminary assessment, (2) preparation of individual water system plans, and (3) an areawide supplement. Required details for individual plans are graduated according to system size.

- Regulations of the drinking water program have expanded the scope of standards for finance, operation, and management to encompass small systems.

Source: Derived and adapted from Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), chapter 3.

In Pennsylvania, where small system viability has a prominent place on the regulatory agenda, much attention is being paid to the development of better, more comprehensive procedures of water utility regulation. A recent report emphasizes the importance of the certification process as the state's principal screening device for emerging water systems.[36] The proposed screening process for new systems is illustrated in figure 3-1. It emphasizes early coordination among the Department of Environmental Resources (DER), the Public Utility Commission, and local planning agencies. The application process further emphasizes the water system's capability in preparing a facilities plan as well as a business plan consisting of relevant management and financial data. The state agencies would use these plans to explicitly evaluate the proposed system's viability. Again, regulatory involvement before a system is established is very important, especially for small water systems.

While many planning issues encompass large geographic regions, coordination with local planning or zoning agencies, such as county boards or development commissions, may prove to be a critical factor in reducing the proliferation of nonviable small water systems. Local officials approving real estate development must be accountable for the adequacy of water supply and other infrastructures for

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[36] Wade Miller, *State Initiatives.* See also John E. Cromwell, III, Walter L. Harner, Jay C. Africa, and J. Stephen Schmidt, "Small Water Systems at a Crossroads," *Journal of the American Water Works Association* 84 no. 5 (May 1992), 40-8.

New System Viability Screening Process

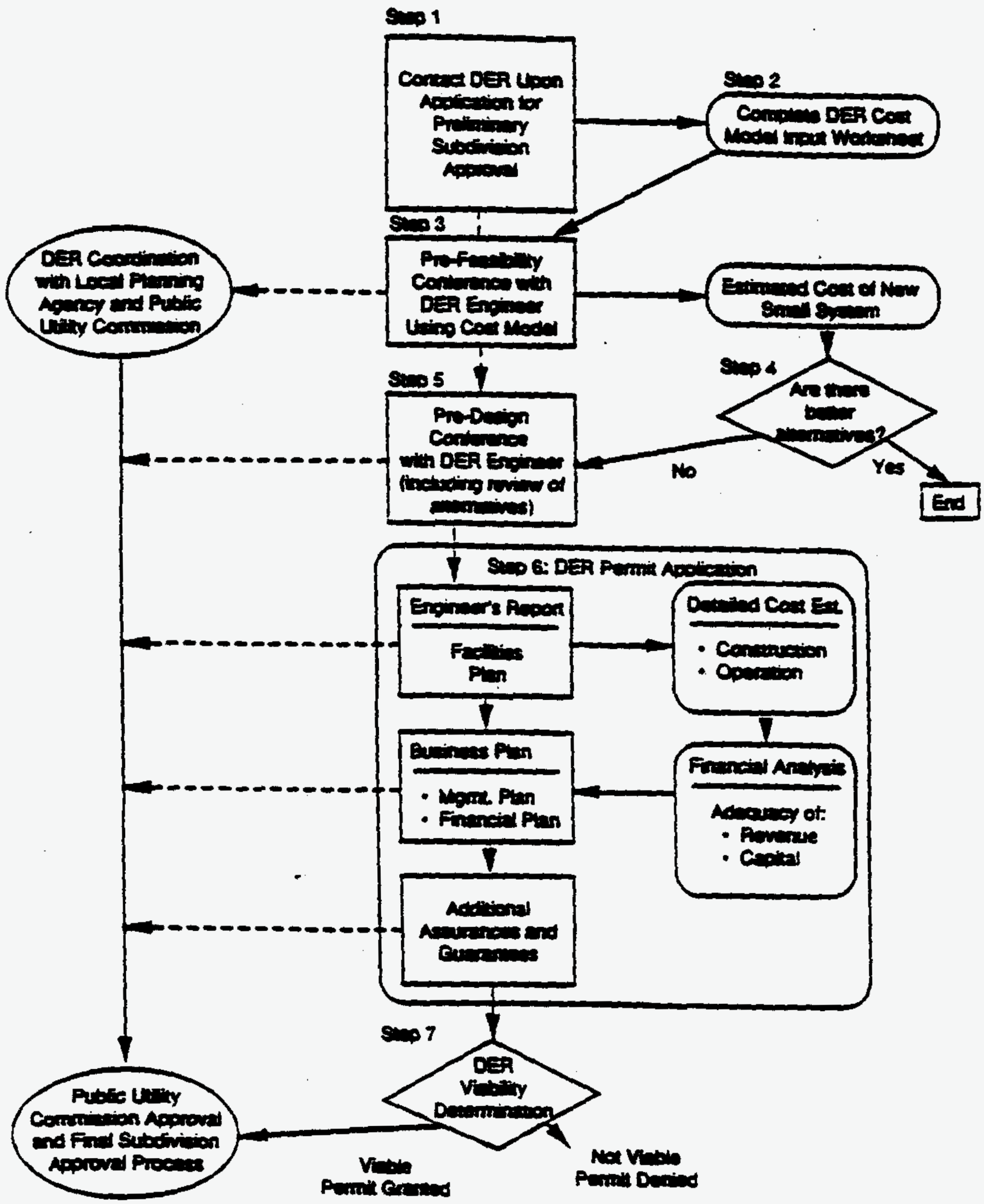

Fig. 3-1. Pennsylvania's proposed viability screening process for new water systems as depicted in Wade Miller Associates, Inc., *The Nation's Public Works: Report on Water Supply* (Washington, DC: National Council on Public Works Improvement, 1987), B-3.

that development. One way to ensure this is to make local government units themselves ultimately responsible for providing service should new systems fail.

The burden of proof in certification must fall on would-be water systems within a comprehensive, integrated water resource planning framework. Within this framework, regulators should ask whether the system can provide safe, adequate, reliable, and environmentally benign service at least cost and consistent with statewide, regional, and local planning goals. In the interest of promoting the long-term viability of the water supply industry, it is reasonable to require utilities seeking certification to demonstrate that alternatives to the creation of a new system have been exhausted. Further fragmentation of the industry only exacerbates its difficulty in complying with comprehensive policies. It also is reasonable to require new systems to back up their venture with assurances that another entity can provide water service should they fail to do so.

Although most policies toward new water systems can be classified as nonproliferation policies, because their aim is to prevent the emergence of new small water systems, some small systems will emerge anyway. Their emergence, in fact, may be well justified and well planned.[37] If public policies toward emerging systems are working well, only systems with a good chance of survival will get certified and begin operations. Unfortunately, past proliferation is to blame for the existence of many existing nonviable systems. Policies for these systems are addressed in the next chapter.

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[37] Using Ohio as a case study the Council of State Governments has published a citizen's "how-to" guide for creating a small community water supply system. The Council of State Governments, *An Insider's Guide to Creating a Small Community Water Supply System* (Lexington, KY: The Council of State Governments, undated).

CHAPTER 4

VIABILITY POLICIES FOR EXISTING WATER SYSTEMS

Past proliferation and financial distress caused by a variety of factors have resulted in the existence and persistence of thousands of small water systems whose viability is precarious. For failing water systems, institutional solutions--regulatory, structural, and comprehensive--are virtually imperative. While the primary issue for emerging water systems is a regulatory one (namely certification), for existing systems issues of structure are especially important, reflecting a strong interest in improving the industry's efficiency and, hence, viability.

Regulatory Policies

As emphasized in chapter 3, regulatory tools are essential in screening new water utilities to help assure viability at their inception. However, even the most carefully crafted certification policies will not prevent some systems from emerging that will have trouble down the road. The role of regulation in affecting viability goes well beyond certification, especially for small water utilities. As with emerging systems, two key state agencies that implement policies toward existing systems are the drinking water authorities and the public utility commissions.

Appendix C of this report provides several state statutes addressing the issue of small water system failure and empowering state regulators to do something about it: Connecticut (takeover statutes), Nevada (assumption of control by a local governing body), New Jersey (failure and takeover), Pennsylvania (acquisition adjustments, takeovers, and receivership), Texas (certification, receivership, and state supervision), and Washington (failure and receivership).

State Drinking Water Authorities

Small systems have long benefitted from assistance by state regulatory agencies, a situation that stands in stark contrast to the relationship of regula*tors* to regulat*ed* in most other sectors. Over the years, state drinking water agencies have provided a variety of services, most of which are paid for by the utilities through fees. A mid-1980s survey identified several of these services:[1]

- Emergency assistance (provided by 100% of the states surveyed)
- Training courses (81%)
- Corrosion control consultation (81%)
- Calibrate monitoring equipment (81%)
- Engineering, materials, and equipment advice (81%)
- Laboratory support (80%)
- Guidance on institutional alternatives (72%)
- Operation and maintenance consultation (67%)
- Water accountability advice (54%)
- Water treatment studies (51%)
- Planning assistance (44%)
- Sanitary surveys (25%)
- Rate case assistance (23%)
- Preparation of rate case applications (5%)

Of course while few state drinking water program administrators provide rate case assistance to water systems, state public utility commissions often do, as noted below. In addition, half of the states surveyed reported being supported by other government units (such as county health departments) in regulating and providing technical assistance to small water systems.[2] State-sponsored local loan programs have been one of the traditional sources of financing for small water utilities.[3]

However, the *assistance* role of state drinking water authorities has been eclipsed by their *regulatory* role under federal drinking water regulations. As Robert McCall observed in 1986:

> Traditionally, state agencies were more oriented toward support services with the backup of regulation when needed. With the passage of the Safe Drinking Water Act of 1974, regulatory agencies were obligated to become more regulatory oriented resulting in discernible decreases in the traditional service

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[1] Robert G. McCall, *Institutional Alternatives for Small Water Systems* (Denver, CO: American Water Works Association Research Foundation, 1986), 65-7.

[2] Ibid.

[3] Barry R. Sagraves, John H. Peterson, and Paul C. Williams, "Financial Strategies for Small Systems," *Journal of the American Water Works Association* (August 1988): 42.

programs and the necessity in some states to charge for some services.[4]

The more stringent requirements of the 1986 amendments to the Safe Drinking Water Act (SDWA) along with more limited state resources have served to strengthen the emphasis of state drinking water programs on regulation as compared with assistance and service. While many states continue to offer grant and loan programs for small water systems, these programs generally have limited availability for privately owned firms, are constrained by state budgets, and are not sufficient to cover the financial needs of the industry. Unfortunately, at the time small systems need this assistance the most to improve regulatory compliance, it is far less accessible.

One type of assistance that still shows signs of life is state loan programs. Loan applications can be used by the states as a viability screening device for existing water utilities. The nation's most well established program is PENNVEST (established under the authority of the Pennsylvania Infrastructure Investment Authority Act). The application process for financial assistance under the PENNVEST program consists of consultation, planning, and coordination with the Department of Environmental Resources engineer.[5] Several other states, including Missouri, are developing loan programs for small systems, too. One important feature of these programs is that they involve assistance not only for publicly owned utilities (as is the case with many public programs), but privately owned ones as well.

Some forms of assistance once provided by the state are now being provided through private initiatives, something the U.S. Environmental Protection Agency encourages. Small utilities are encouraged to take advantage of the publications, programs, and services made available through such organizations as the American Water Works Association, the National Rural Water Association, the Rural Community Assistance Program, and the National Small Flows Clearinghouse.[6] Assistance organizations also are emerging at the state level. In Ohio, the

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[4] Ibid., 65.

[5] Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), 9-3.

[6] See the listing at the end of the bibliography.

Association of Rural Water Systems formed a nonprofit corporation, Small Systems Assistance, Inc., "to help small water systems achieve compliance with EPA regulations, providing training to the small system operator and have certified operators on call to work with system operators to solve operation, maintenance, and management concerns."[7]

In keeping with the increasing focus on regulation, strengthening operator certification has become a priority in a number of state drinking water agencies.[8] The New Hampshire Department of Environmental Services requires water system operators to attend a course and demonstrate proficiency in order to have their certificates renewed. The state facilitates the educational process and helps water systems build reference libraries by purchasing textbooks in bulk at a discount and making them available to operators attending classes sponsored by the state. Utah also plans to revise its program of minimum training requirements for water system operators and continuing education credits for renewals.

Regulatory enforcement of drinking water standards can play a key role in improving the viability of the water supply industry though the individual water suppliers may not see it that way. When a firm repeatedly cannot meet regulatory standards, this should send a signal to regulators that the firm's viability may be questionable. Many institutional alternatives that regulators can affect, including such drastic measures as mandatory takeovers, are grounded in the desire to improve regulatory compliance. Of course, SDWA compliance is only one measure of water system performance and only one type of trigger for intervention.

The EPA encourages state drinking water authorities to expand their role in improving small system viability. Its recommendations appear in table 4-1. Some methods (such as outreach) involve direct effects on system performance while others (such as certification and planning) are indirect, or more institutional in nature. The methods also vary in terms of cost to the agency with more costly alternatives probably requiring a longer implementation timeframe. Another strategy

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[7] Charles McFarland, "Small System Assistance Inc.: A Problem-Solving Approach," *The Ohio Small Systems News*, (Spring 1992).

[8] *Small System Viability Bulletin* (Office of Ground Water and Drinking Water, U.S. Environmental Protection Agency) no. 6 (August 1991): 2-3.

TABLE 4-1
EPA RECOMMENDATIONS FOR DRINKING WATER ADMINISTRATORS IN IMPROVING EXISTING SYSTEM VIABILITY

Recommendation	Direct or Indirect	Cost
Develop a policy	Direct	Low
Conduct outreach	Direct	Medium
Develop satellite plans	Direct	Medium
Obtain authority to implement involuntary mergers/acquisitions	Direct	Medium
Strengthen operator certification requirements	Indirect	Low
Implement operating permits	Indirect	High
Conduct areawide planning	Indirect	High

Source: U.S. Environmental Protection Agency, *Improving the Viability of Existing Small Drinking Water Systems* (Washington, DC: U.S. Environmental Protection Agency, 1990), 26.

encouraged by the EPA is better coordination among state regulatory agencies, including the public utility commissions, as discussed below under comprehensive policies..

State Public Utility Commissions

Because of the nature of commission jurisdiction, the state public utility commissions have a substantial role in addressing the small systems problem.[9] The viability of small water systems has long been a source of concern to regulators but only recently have some fairly aggressive regulatory tools emerged to help them

9 Raymond W. Lawton and Vivian Witkind Davis, *Commission Regulation of Small Water Utilities: Some Issues and Solutions* (Columbus, OH: The National Regulatory Research Institute, 1983).

address it. These tools are not confined to the certification of new systems, as addressed in the previous chapter, but also apply to existing systems.

The mainstay of public utility regulation is ratemaking. It is in this process that many small systems come to the attention of regulators in the first place. Commissions spend an inordinate amount of time on water utility regulation relative to the size of this industry (compared with other regulated industries), because of the problems of small systems. Many commissions have tailored the regulatory process to the needs of small water systems.

Many states provide simplified procedures for small systems, including simplified rate filings (twenty-two commissions) simplified hearings or proceedings (twelve commissions), simplified reporting (twelve commissions) and other forms of assistance or simplification (eight commissions).[10] In addition to their regulatory roles, commissions also provide assistance to small utilities. Many have access to a variety of resources for improving the effectiveness of regulation and the condition of the systems they regulate.[11] Commission roles include referral and coordination with other organization, advocacy before other agencies, and direct provision of services or assistance to small systems. Agency staff in Arizona and Ohio are among those who publish occasional newsletters directed at the small water utilities under their jurisdiction.

Commission staff often have more expertise than small system operators in terms of ratemaking issues, especially in determining revenue requirements and designing rates. In some cases, staff have been known to recommend a rate increase higher than that requested by the utility in order to improve its financial picture (something almost unheard of in the regulation of other public utilities). State regulation also may force some utilities to do a better job of recordkeeping. The Public Utilities Commission of Ohio uses the annual reports both "to ensure that the financial integrity of each utility is being maintained" and to develop "financial ratio standards for the industry and studies in the long-term trends of

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10 Janice A. Beecher and Patrick C. Mann, *Deregulation and Regulatory Alternatives for Water Utilities* (Columbus, OH: The National Regulatory Research Institute, 1990).

11 Vivian Witkind Davis, J. Stephen Henderson, Robert E. Burns, and Peter A. Nagler, *Commission Regulation of Small Water Utilities: Outside Resources and their Effective Uses* (Columbus, OH: The National Regulatory Research Institute, 1984).

these measurements."[12] As in the case of enforcing state drinking water regulations, enforcing commission regulation can have a positive effect on viability because of the performance incentives (and disincentives) provided.

Commissions are being asked to design (and are being empowered to implement) new policies dealing with the problems of small water systems. Many of these policies concern structural solutions (such as acquisition adjustments and mandatory takeovers) and are discussed below. Some concern specific methods of ratemaking. For example, as noted in chapter 2, many small water systems have no rate base or even a negative rate base. The use of operating ratios to determine revenue requirements can be used in such cases.[13] However, this methodology does not resolve the underlying problem (assuming one perceives it as a problem), of lack of rate base.

Increasing in importance is the role of regulation in helping (or hindering) small water utilities cope with the financial pressures brought on by the Safe Drinking Water Act (SDWA). For example, one of the most promising developments in the area of financial assistance is the emergence of private lenders, such as Heartland Resources, Inc., whose program specifically is designed to meet the needs of small water systems.[14] Heartland emphasizes establishing good working relations with utility regulators, who must approve the project being financed and be familiar with the terms of the loan. Heartland also requires, however, that all needed rate increases or surcharges be put into effect prior to the loan's closing.

In addition to concerns about ratemaking treatment (such as the use of special surcharges) the issue of whether regulatory lag will present a potential barrier to financing also emerges. For some jurisdictions, this and similar situations may raise the issue of using a future test year in projecting utility expenses as well as other ratemaking issues, such as the use of phase-in plans, allowances for funds used during construction (AFUDC), funding for construction work in progress (CWIP), and contributions in aid of construction (CIAC). A big issue for debate is whether some

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12 *Water and Sewer Newsletter* (Public Utilities Commission of Ohio) 4 no. 2 (November 1991): 12.

13 Robert M. Clark, "Regulation Through Operating Revenues--An Alternative for Small Water Utilities," *NRRI Quarterly Bulletin*, 9 no. 3 (July 1988), 343-53.

14 "Small Company Loans," *Water* (National Association of Water Companies) 32 no. 3 (Fall 1991): 41. Heartland Resources, Inc., can be reached at (212) 490-2464.

form of commission preapproval of utility investments (or the debt service associated with them) is desirable, especially in light of SDWA requirements.[15]

For systems in crisis, some fairly dramatic solutions can be imposed. As already discussed, public utilities rarely actually file for bankruptcy. Still, some states (such as Missouri, Pennsylvania, Texas, and Washington) have found it necessary to strengthen their receivership authority so they can, at least temporarily, assure that utility operations do not fail altogether. Receivership is a drastic measure but may become necessary to preserve service. It may lead to more permanent structural solutions, as discussed below.

Under significant new authority, the Texas Water Commission can now place water systems they consider to be in severe financial trouble under the direct supervision of the agency.[16] As of 1992, a few systems in the state were under such supervisory status. Commission staff put the systems on a "financial diet" and emphasize careful recordkeeping. Cash is set aside for contingencies, which is a practice many small water utilities probably do not follow. Major cash outflows must be approved according to priorities, and salaries to utility personnel have a lower priority than payments to creditors.

In an extreme case, some commissions may revoke a water system's certificate of convenience and necessity. In Texas, the Water Commission can, after notice and hearing, revoke a certificate if it finds that the certificate holder has never provided, is no longer providing, or has failed to provide continuous and adequate service in the area, or part of the area, covered by the certificate (see appendix C.) As a matter of policy it generally is used in conjunction with granting a certificate to another entity better able to provide service. Most commissions would be reluctant to exercise this authority in such a way that community water service was discontinued altogether.

On occasion, a reduction of regulatory jurisdiction is proposed as a means of solving "the small water systems problem." Drinking water authorities generally do not have the option of exempting problem systems from regulation. However, the jurisdiction of the state public utility commissions is defined by various forms of

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[15] The rationale for preapproval might be easier for small systems, whose access to capital is severely limited.

[16] Per interview with George Frietag of the Texas Water Commission in March 1992.

selective exemption. The Iowa State Utilities Board, for example, only regulates investor-owned systems serving more than 2,000 customers (only one system at the present time). Deregulation from an economic standpoint does reduce regulatory costs and administrative burdens on regulated firms. However, deregulation in no way solves the persistent problems of small water systems and, in fact, may make matters worse by eliminating oversight as well as opportunities for authoritative intervention. Regulation can enhance survival by compelling utilities to improve their technical, financial, and managerial performance. Another important role for regulators is to promote restructuring the water supply industry as opportunities arise to make it more efficient and ultimately more viable.

Structural Policies

A fundamental and necessary approach to the problems of existing nonviable small water systems is to promote changes in the institutional structure of water supply, specifically by promoting consolidation or regionalization. These structural (really, "restructural") policies will play a critical role in the industry's future. An early study on this point recognized that consolidation would not be advantageous only to the industry:

> The potential advantages of large regional systems appear to result from economies of scale and size that can partially offset rising consumer costs with the declining unit costs that occur as system size increases. . . . Another benefit of consolidation would be to regulatory agencies, who would have fewer systems to monitor. . .[17]

Because viability seems inexorably linked to economies of scale, there is a strong interest in consolidation solutions, which can be implemented gradually and may be essential to the long-term health of the water-supply industry.

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17 Donald L. Hooks, *Treated Water Demand and the Economics of Regionalization* (Cincinnati, OH: Municipal Environmental Research Laboratory, U.S. Environmental Protection Agency, 1980), 2.

Consolidation not only is more efficient, but it also provides a means of reducing the risk of failure for individual water systems.[18]

Alternatives

Structural alternatives for existing water systems vary in complexity and the resources required for implementation. Informal agreements, for example, constitute a more modest solution, while consolidation through mergers and acquisitions involves a more substantial commitment to restructuring. The more substantial options usually affect the ownership character of a water system. Thus structural options in general reflect institutional relationships rather than physical or hydraulic ones, although hydraulic interconnection of systems is more likely to occur in more formalized, structured relationships. Economies can be manifested in physical facilities but also in other areas of utility operations (such as billing and collections).

The view adopted here is that any institutional change promoting economies of scale or scope for existing water systems is a structural solution. Other subclassification schemes (such as structural versus nonstructural regionalization) sometimes are used.[19] For this analysis, however, a continuum of relationships, each implying a more dramatic effect on the institutional character of utility service, seems to be more appropriate to the understanding of these structural choices. A prominent study of regionalization also begins with this view:

> Regionalization is the administrative or physical combination of two or more community water systems for improved planning, operation, and/or management. Regionalization should be viewed in the context of a *range of possible approaches*, from the actual physical interconnection of systems to an administrative and management arrangement to provide

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[18] David W. Prasifka, *Current Trends in Water-Supply Planning: Issues, Concepts, and Risks* (New York: Van Nostrand Reinhold Company, 1988), 17-20.

[19] Sometimes a useful distinction can be made between "software" approaches (such as agreements) and "hardware" approaches (such as sharing physical facilities).

common technical, operational, or financial services for two or more systems.[20]

Appendix D of this report provides definitions as well as a listing of the advantages and disadvantages associated with various regionalization options derived from research by SMC Martin, Inc. for the Environmental Protection Agency and by Robert G. McCall for the American Water Works Association Research Foundation.[21] Regionalization options range from fairly modest and informal methods to more permanent and structurally significant alternatives. Some examples, based on EPA case studies, appear in table 4-2 below. As discussed below, some of the structural options that might be undertaken to alleviate the problem of small water system viability include informal agreements among systems, formal agreements among systems, satellite management of a smaller system by a larger system, voluntary mergers and acquisitions, mandatory takeovers, and public ownership. Following their description is a discussion of implementation issues.

Informal Agreements

Informally, water systems can assist each other in a variety of ways. An informal agreement is a voluntary cooperative arrangement between water systems or between a water system and another service entity to provide a needed function or share a common facility. Systems can share laboratory facilities, storage facilities, and billing equipment; they can provide water to each other on an emergency basis; and they can share operation and maintenance functions or personnel. Perhaps most important in the era of the Safe Drinking Water Act is the sharing of technical expertise specifically directed toward improving regulatory compliance. Another form of informal agreement can be realized through regional councils of local officials, which provide a nonbinding forum for identifying

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20 SMC Martin, Inc., *Regionalization Options for Small Water Systems* (Washington, DC: U.S. Environmental Protection Agency, 1983), III-1. This study goes on the make the distinction between structural and nonstructural forms of regionalization, which is not adopted here in favor of the idea of a continuum of choices all involving structure.

21 SMC Martin, Inc., *Regionalization Options,* and Robert G. McCall, *Institutional Alternatives for Small Water Systems* (Denver, CO: American Water Works Association Research Foundation, 1986).

TABLE 4-2
USEPA CASE STUDIES OF STRUCTURAL SOLUTIONS
FOR EXISTING WATER SYSTEMS

Contracts with Private Vendors	• Waterguard, Inc. provides small systems in Oregon with routine testing and maintenance, regulatory and ratemaking advice, financial analysis, and bookkeeping.
	• Wastewater Service, Inc., provides O&M services on contract with small water systems in North Carolina.
	• Crosby Water and Sewer Services, begun by a mobile home park owner who became a certified water supply operator, provides O&M and emergency and management services to small systems in North Carolina.
Contracts With Other Utilities	• A homeowners' association in Washington contracted with Public Utility District No. 1 of Kitsap county for a comprehensive system assessment.
	• Southern New Hampshire Water Company provides O&M services to a small municipal water system.
Mandatory Takeover (Private)	• Under the state's takeover legislation, the Connecticut Department of Health Services (DOHS) and the Department of Public Utility Control (DPUC) jointly determined that Bridgeport Hydraulic Company should takeover Greenacres Water Supply, a nonviable small water system.
	• Citing regulatory compliance problems with both agencies, the Connecticut DOHS and DPUC order the receivership and ultimately the takeover and improvement of two divisions of Helms, Inc. by the Connecticut Water Company.
Mandatory Takeover (Public)	• In 1981, in conjunction with county-based water planning authority, the Maryland Department of Environment ordered the extension of municipal water service from the City of Hagerstown to residents outside its boundaries.
Formation of a Public System	• Lakewood Village replaced its developer-run system with a benefited water district, made possible through a federal loan, a special tax assessment, and the negotiated purchase of wholesale water from the city of Des Moines, Iowa.
	• State loans and a grant made is possible for the formation of a regional water system in North Lakeport, replacing numerous small water systems.

Source: Authors' derivation from U.S. Environmental Protection Agency, *Improving the Viability of Existing Small Drinking Water Systems* (Washington, DC: U.S. Environmental Protection Agency, 1990).

problems common to a region and promoting mutually agreeable solutions.[22] This type of agreement may be especially appropriate for publicly-owned water systems. Water districts, rural cooperatives, and homeowners' associations, for example, might band together to share resources and expertise.

In some cases, informal agreements can yield certain economies of scale for the systems and ratepayers involved. The informality of the agreements, however, is both an advantage (in terms of flexibility) and a disadvantage (in terms of long-term stability). Also, more significant economies arguably can be gained through more formal agreements.

Formal Agreements

Informal relationships among water utilities can be formalized under a basic service contract, which is a legal agreement between water systems or between a system and a service company to provide a service.[23] Services potentially subject to such a contract include water plant operation and maintenance, distribution system maintenance, billing and collection activities, and emergency and repair functions. In addition, some systems may enter into water purchase contracts on a wholesale or retail basis. Some small systems can enter into contracts with "circuit riders" who provide operational and managerial services. Others might pool resources to hire engineering or consulting firms on a short-term basis. As in less formal arrangements, basic service contracts can improve system economies and mitigate against the risks associated with small system operations. Such agreements also may lead to more formalized arrangements.

A joint service agreement is a more formal and somewhat more complex method for sharing or exchanging activities among water systems or service entities.[24] Such agreements may be used for the development of water sources; common ownership of system facilities, equipment, and vehicles; purchase of equipment, chemicals, and mechanical parts; and the exchange or sharing of service activities, such as operation and maintenance, and billing and collections. An example is the joint purchase of meters by members of a regional water association

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22 Ibid. See appendix E.

23 Ibid.

24 Ibid.

in order to get a lower per-unit price. Another is the use of formalized agreements to help utilities respond to drought and other water supply emergencies.[25] In addition to economic advantages, such agreements are more stable than informal agreements. For systems where physical interconnection is precluded, informal and formal agreements can help systems take advantage of scale economies, even though they may be limited. For some systems, these agreements may precede more permanent structural relationships that seek to extract additional economies for the systems involved.

Satellite Management

Along the continuum of structural alternatives, satellite management is a further expansion of relationships defined under formal agreements. According to Robert G. McCall:

> A satellite operation refers to the process by which a larger or central water utility assists a small system by (1) providing varying levels of technical, operational, or managerial assistance on a contract basis; (2) providing wholesale treated water with or without additional services, or (3) assuming ownership, operation, and maintenance responsibility when the small system is physically separate from another source of supply. A system is not considered a satellite when it is physically connected to and owned by the larger utility.[26]

This very broad definition encompasses a variety of relationships, even changes in ownership (which typically constitute mergers or acquisitions). Similarly, Connecticut regulations specify that satellite management is accomplished through ownership or contractual arrangement by which a utility assumes full managerial and financial responsibility for any new noninterconnected systems within its exclusive service area.[27] In addition, utilities are responsible for using satellite management or other means of assisting failing water systems in their area.

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25 Donald Hooker, "A Regional Response to Water Supply Emergencies," *Journal of the American Water Works Association* 73 (May 1981): 232-37.

26 McCall, *Institutional Alternatives*, 35.

27 James R. McQueen, "Takeover of Small Failing Water Systems," *Proceedings of the Annual Conference of the American Water Works Association, 1991*. Denver, CO: American Water Works Association, 1991, 341-45.

Perhaps the most important elements of a satellite arrangement are the more formalized responsibilities of a larger, more viable entity and the fact that it remains physically separate from the small water system. The large and small water systems involved in a satellite relationship may be of like ownership (public or private) or not. Though the managing agent is typically another water utility, it might conceivably be another type of utility (such as an electric utility), a private vendor, a nonprofit association, or a government agency. Whatever the arrangement, satellite management provides a means of sharing managerial expertise with systems lacking this essential resource, although the technical and financial performance of managed systems should be positively affected as well. When a larger system assumes responsibility for several smaller systems, satellite management becomes a rudimentary form of industry consolidation and should result in improved economies.

Several water utilities now have had substantial experience with satellite management. There is some evidence that satellite management can improve system conditions, enhance reliability and adequacy of supplies, and bring systems into compliance with drinking water regulations.[28] Even though costs and rates may increase as a result, they may actually increase by amounts less that what would be required if the smaller system continued operations alone, particularly when trying to meet drinking water regulations. In other words, many small systems are operating in a deficit position in the first place, so an increase in costs (to remedy problems in quality and reliability) can be expected whether or not a structural change is implemented.

Mergers and Acquisitions

From a public policy perspective, the merger of utilities or the acquisition of one utility by another is an attractive solution to the viability problem. The larger utility resulting from the merger or acquisition should benefit from greater scale economies in production, better access to capital, a larger customer base, more management capabilities, and so on. The overall financial character of a larger system is less precarious than the smaller one. Finally, the larger system is in a better position to meet regulatory requirements (both economic and public health) and provide a higher standard of water service.

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[28] McCall, *Institutional Alternatives.*

Acquisition activity among water systems subject to state commission regulation in 1990, not surprisingly, was most substantial in those states with many water systems, as reported in table A-7 of appendix A. Leading the states in mergers and acquisitions were North Carolina (ninety-one), Texas (seventy), Arizona (eighteen), Florida (fourteen), and California (twelve).[29] A 1989 NRRI survey reported acquisitions according to the nature of the acquiring entity. Nationally, acquisitions by nonprofit organizations (homeowners' association, cooperative, or other not-for-profit organization) were estimated at about thirty-three; acquisitions by local governmental units (city, county, or water district) were estimated at eighty-nine; and acquisition by investor-owned water systems at one-hundred forty-three.[30] Four other systems were acquired by another private entity, including other (nonwater) utilities.

According to a commission staff member, key factors for consideration in deciding to take over a water system include the systems' physical proximity, their condition, and the amount of capital needed to bring the smaller system into compliance with regulatory standards, and the disposition of the state public utility commission.[31] Mergers, acquisitions, and other transactions involving the assets of investor-owned and other types of water utilities generally require approval by the state public utility commission, which may attach conditions to the deal. If the resulting structure involves a parent company with subsidiaries, a variety of additional regulatory oversight issues arises.[32]

Acquisitions can occur in three distinct ways. First is the private, voluntary merger of a smaller system with a larger one. In this case, no regulatory involvement occurs until the transaction must be approved by appropriate regulatory agencies. A second type occurs because regulators provide a certain degree of

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29 These findings are consistent with earlier findings by the NRRI reported in Mann, Dreese, and Tucker, *Mergers and Acquisitions*.

30 *1990 NRRI Survey on Commission Regulation of Water Systems*.

31 Kenneth D. Miceli, "The Problems of Small Water Companies and the Takeover as a Solution," *Proceedings of the Fifth NARUC Biennial Regulatory Information Conference* (Columbus, OH: The National Regulatory Research Institute, 1986), 1421-35.

32 See Robert E. Burns, Peter A. Nagler, Kaye Pfister, and J. Stephen Henderson, *Regulating Electric Utilities with Subsidiaries* (Columbus, OH: The National Regulatory Research Institute, 1986).

pressure on larger utilities to acquire small nonviable systems. In California, Resolution M-4178 made it the Commission's policy to "support and promote the conversion of unviable or marginal investor owned water utilities to public ownership or to support their mergers with more viable entities when opportunities arise."[33] Some agencies may go a step further by considering specific ratemaking incentives, such as acquisition adjustments or higher rates of return, to make the deal more attractive. In Pennsylvania, a state statute provides for acquisition adjustments at the commission's discretion. Finally, as discussed below, some states now have takeover statutes whereby acquisitions can be mandated.

Although their small system viability policy has been largely successful, the staff of the California Commission continues to be concerned about the unwillingness of some small utilities to divest their companies at a reasonable price to willing buyers, as well as the possibility that purchase prices exceed depreciated rate base so that buyers cannot earn a reasonable return on their investment.[34] In one case, for example, the commission would not approve a sale because of the high sale-price-to-book-value ratio (2.57:1) and because of the high ratio of debt to equity (8:1) resulting from the sale.[35] The Commission believes that by scrutinizing highly leveraged sales it can help prevent the precarious situation in which new owners are strapped by debt service and lack sufficient revenues for maintenance and capital expenditures.

Mandatory Takeovers

As mentioned, the mandated takeover of a financially troubled water utility is now an option in some states and may become a trend if more states enact and exercise this authority. Municipalities in Maryland, for example, can take over failed private systems by agreement or, if necessary, by condemnation. In Nevada, a local governing body can take over an existing water system upon finding it necessary to do so to protect the public. After thirty days a court order is

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[33] Ibid.

[34] Fassil T. Fenikile, *Staff Report on Issues Related to Small Water Utilities* (San Francisco, CA: Public Utilities Commission, 1991), 13.

[35] "Interim Order: Commission Denies Application for Sale of Madera Ranchos Water Co., Decision 91-07-067, July 24, 1991," *NRRI Quarterly Bulletin* 12 no. 4 (December 1991), 578.

required for an extension of the period of control. As noted in chapter 3, Nevada's state drinking water authority also can force a local governing body to assume responsibility for a water system in the case of failure.

Even more controversial is the mandatory takeover of a utility by a privately owned utility, legitimate in Connecticut, New Jersey, and Pennsylvania. In New Jersey, for example, the state can mandate the takeover of utilities unable to comply with water quality standards by another private or public water utilities. Mandatory takeover policies put state utility regulators in a position of implementing state policies that may go beyond traditional regulatory roles, namely the consolidation of the water supply industry.

Water utilities in Connecticut are among the first to report on their actual experience with the mandated takeover of failing water systems:

> The utilities in Connecticut are indeed cognizant of the problems with failing water systems. Some.... already have experienced the financial and operational burden of taking over poorly run systems. Although rate relief may be provided by the [Department of Public Utility Control] for regulated utilities that relief doesn't normally come until after the improvements have been made. Municipal-owned systems can be faced with additional bonding/ debt service requirements when they take over a failing system. Ideally, a loan system should be available to allow the failing system to solve its own problems. However, if it is determined by the state regulators that the failing system is incapable of generating its own solution, and financial assistance programs are not available, which will most likely be the case in Connecticut, the responsibility for a failing 'orphan' will fall upon the shoulder of the nearest healthy neighbor and be paid for from the pocket of the receiving utility's existing customers.[36]

As reported in table 4-3, the recent experience of the Connecticut Water Company (CWC) in providing both satellite management (to four systems) and service extensions (to six systems) has been mixed.[37] CWC equalizes rates to all customers under authority of the Department of Public Utility Control. When the company assumes responsibility for small systems, all customers are affected by increased revenues (associated with a larger customer base) and costs (associated

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36 McQueen, "Takeover of Small Failing Water Systems," 342.

37 Ibid.

TABLE 4-3
CONNECTICUT WATER COMPANY'S SATELLITES AND EXTENSIONS

Service By (a)	Number of Systems	Number of Customers	Investment per Customer	Total Investment(b) Mil. $	Annual Effect on All CWC Customers(c)		
					Cost	Revenue	Net
Satellites	4	319	$8,363	$2.7	$11.00	$2.19	$8.81
Extensions	6	2,051	2,021	4.1	17.05	17.21	(0.16)
Total	10	2,370	$2,873	$6.8	$28.05	$19.40	$8.65

Source: James R. McQueen, "Takeover of Small Failing Water Systems," *Proceedings of the Annual Conference of the American Water Works Association* (Denver, CO: American Water Works Association, 1991), 345.

(a) Satellites are not physically connected to the parent system; extensions involve main extension from a larger system to a smaller one.
(b) Number of customers multiplied by investment per customer (in millions).
(c) These calculations approximate the impact on water bills for all Connecticut Water Company customers under the existing rate schedule (where rates are equalized).

with rehabilitation). According to a company analysis, satellite management required a higher investment per new customer than extensions (although the total investment required for extensions was higher). Also, because relatively few customers were added to the utility as a whole, the result of satellite management on all CWC customers was a net increase in their costs. The cost of physical extensions of service were greater per CWC customer but because more customers were added to the system through the extensions, the net effect was to lower customer costs (but only slightly). Taken together, the addition of the ten systems increased customer costs systemwide by approximately $8.65 per year. As discussed below under implementation issues, when exploring any structural option it is important to assess cost and ratepayer impacts.

Only time will tell whether mandatory takeovers prove to be an effective policy instrument in addressing the problem of small water system viability. In the meantime, it is important to amass empirical evidence on its impact. Given the alternatives of regulatory noncompliance, astronomical stand-alone costs, or, worse, failure, it would appear that the public interest might be well served by this form of industry consolidation, even though it is an extreme public policy solution that should not casually be chosen:

> Forced consolidation is an expensive legal process that is appropriate only as a last resort. Attempts to force consolidation have met with considerable opposition from water customers, who feel that their interest will be neglected by larger utilities, and from private utilities concerned with their property rights. Except in hopeless cases, consolidation should not be imposed from the top down; instead, it should be achieved through a process of voluntary cooperation.[38]

It is clear that when utilities are forced to put their investments in a failing system, they are assuming a certain degree of risk (not to mention managerial challenges). It is up to regulators to determine whether this risk is significant, how it may affect ratepayers as well as investors, and how to mitigate against it when appropriate. A combination of takeovers with an appropriate system of incentives (including the removal of disincentives) is not an unreasonable policy course once less extreme options have been fully explored. (These and other implementation issues are discussed below.)

Public Ownership

Public ownership through annexation is a structural option involving extending a publicly owned utility's service territory to include outlying areas, such as occurs when service boundaries or corporate limits change.[39] The Fairfax County Water Authority is a regionalized system in Virginia which, through a series of acquisitions around the original Alexandria Water Company, achieved significant economies of scale.[40] Local geopolitical circumstances may determine the feasibility of annexation. While economies of scale may be realized, their magnitude may depend on the potential for physically interconnecting systems. In any case, the

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38 Prasifka, *Current Trends*, 22.

39 Ibid. See appendix E.

40 Robert M. Clark, Minimizing Water Supply Costs: Regional and Management Options," *Proceedings of the American Water Works Association Seminar on Small Water System Problems, June 7, 1981* (Denver, CO: American Water Works Association, 1982), 65-82.

institutional result of annexation by municipalities is a net increase in public ownership, which may or may not be desirable, as discussed in the previous chapter.

Many of the available case studies of regionalization involve publicly owned utilities.[41] According to a study by the U.S. Environmental Protection Agency, acquisitions resulting in larger publicly owned systems could be considered attractive for a number of reasons:[42]

- Counties or municipalities with established water utilities frequently expand to meet new demands within or adjacent to their jurisdictions. In many states, county water districts are willing to provide service when small water systems within their borders become nonviable.
- Some states require publicly owned water systems to take over privately owned water service if a small system is failing.
- Grants and loans are frequently available to finance publicly owned water system, but usually are not available to privately owned water systems.
- Some publicly owned systems have the authority to raise revenues through taxes. These revenues can be used to fund system expansion and improvement.
- Most publicly owned systems can issue tax-exempt revenue bonds, giving them access to low-cost funds for expansion or system upgrades.[43]
- Many publicly owned systems have the power of eminent domain in their operating areas.

Institutionally, it may be easier for states to encourage local governments to acquire small water systems, compared with acquisitions by private utilities. Public ownership also may promote planning. California, for example, has used special

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41 SMC Martin, Inc., *Regionalization Options for Small Water Systems* (Washington, DC: U.S. Environmental Protection Agency, 1983), II-2.

42 U.S. Environmental Protection Agency, *Improving the Viability of Existing Small Drinking Water Systems* (Washington, DC: U.S. Environmental Protection Agency, 1990), 16-7.

43 The 1986 tax code amendments restricted the use of tax-exempt state bonds for industrial purposes. However, bonds still can be used for drinking water projects undertaken by public or private utilities, subject to a state volume cap.

water districts for planning and coordination.[44] However, it could be argued that the important step is in the consolidation with the issue of ownership (at least in the intermediate term) secondary in importance.

Implementation Issues

Actual implementation of structural changes in the water supply industry involves several other issues, such as the need for decision tools for choosing among the alternatives and the need to design incentives for change. The wide scope of issues involved is illustrated in table 4-4. While no simple answers are available, some specific questions that can be raised in choosing a particular approach appear in table 4-5. Of particular importance in evaluating structural alternatives are the issues of risk and reward. Economic regulators are especially concerned about protecting ratepayers.

Some studies have advanced decision criteria for choosing among the available structural alternatives for existing small water systems. In a study of regionalization for the Environmental Protection Agency, for example, SMC Martin, Inc., identified four such criteria:[45]

- Economic efficiency (to provide water supply service at the lowest possible cost).
- Fiscal equity (to distribute the cost of service equally among customers served).
- Political accessibility (to allow for high level of citizen participation in decisionmaking).
- Administrative effectiveness (to deliver water in an efficient and technically proficient manner).

Effective consolidation of the water supply industry, according to another study has several prerequisites for the protection of the entities involved as well as

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44 William R. Smith, "Regional Allocation of Water Resources." *American Water Works Association Journal* 73 (May 1981): 226-31.

45 SMC Martin, Inc., *Regionalization Options for Small Water Systems* (Washington,DC: U.S. Environmental Protection Agency, 1983) I-3.

TABLE 4-4

ISSUE FRAMEWORK FOR STRUCTURAL ALTERNATIVES FOR EXISTING WATER SYSTEMS

Geopolitical Issues

- Geographic location of service territories and facilities
- Local politics and culture of each customer base
- Potential for structural and nonstructural relationships

Management Issues

- Degree of cooperation, conflict, and control
- Personnel roles and responsibilities
- Philosophical compatibility

Economics and Finance Issues

- Liabilities and risk
- Financial and accounting practices
- Revenue requirements and ratemaking implications

Planning Issues

- Financial planning
- Integrated least-cost resource planning
- Land-use, economic development, and other planning processes

Regulatory Issues

- Approval by safe drinking water administrator
- Approval by state public utility commission
- Federal and regional regulatory considerations

Source: Authors' construct.

TABLE 4-5
KEY QUESTIONS RELATED TO STRUCTURAL ALTERNATIVES FOR EXISTING WATER SYSTEMS

General

- Do state statutes restrict the authority of the participants to implement the approach? What legal requirements are imposed by these statutes?
- Is there adequate trust and mutual cooperation among the participants?
- Are the pooled resources of the participants adequate to meet any increased requirements created by the implementation of the regionalization option?
- How will costs incurred in implementing and administering the entity be distributed among the participants and customers served? What is an appropriate method for determining these costs? What financing and funding sources become available to the entity?

Legal Authority

- For local governments, can expenditures and revenues be increased without going through a supplemental budgetary process? If not, what steps must be taken to get supplemental funding?
- For agreements, does state law indicate that it is binding on future governmental bodies? Does the law specify or suggest language to be used on the agreement? (Uniform language facilitates multijurisdictional participation.)
- What is the normal life cycle of the regional entity or what is the general term of the service agreement?
- Who possesses the legal authority to create the regional entity or service agreement? Must the regional entity or service agreement be reviewed for conformance with the requirements of state law or local charters?
- Under what conditions can the entity or service agreement be terminated or dissolved? What steps must be taken to initiate termination or dissolution?
- What sources of revenue are available to pay for the service?
- Do specific legal requirements address such issues as liability, damages, and property disposition at the termination of the service agreement?
- Does the law address requirements for the hiring, release, or status of personnel affected by the service agreement or employed by the regional entity?
- Are specific requirements available to amend basic service contracts and service agreements to adjust to different levels of service and attendant costs?

TABLE 4-5 (continued)

Costs and Resources

- If a customer does not pay for the actual costs of a service provided, will the question of subsidization arise and what problems can be expected?
- Should an overhead factor be based on a prorated cost of all labor costs, depreciation of assets, rent, and liability insurance? Should only costs identified over and above overheads be used?
- What is an adequate method of determining costs and payment schedules? What mechanisms should be used to adjust costs to reflect inflation of labor, equipment, and supply costs?
- In determining costs, should consideration be given to the financial status of the recipient systems? How will this affect the delivery of service to the individual systems in terms of their ability to pay for the service?
- What forms of federal and state funding are available to the regional entity? How do funding requirements affect the general financing of a capital improvements project, including user charges?
- What changes in resources are expected to be necessary to provide the service (personnel, facilities, equipment, etc.)?
- Are sufficient resources available to provide areawide service coverage to benefit from increasing economies of scale?
- Will the approach require a reallocation and relocation of personnel and facilities? How will total costs be affected and who should pay?

Policy and Political Constraints

- What is the expected public reaction to the regional proposal, including a possible tax increase or user charge? Is public support sufficient?
- Will the increase in the level and quality of service offset any negative public reaction to a tax or user charge increase? What are the best methods to publicize the benefits accruing from a regional approach?
- To which entity should citizens complain about the service: the provider or recipient water system or the governmental unit?
- What policy control will the participants lose to the regional entity?
- What problems are anticipated during the transition of service?

Source: Adapted from SMC Martin, Inc., *Regionalization Options for Small Water Systems* (Washington, DC: Environmental Protection Agency, 1983).

their ratepayers.[46] First, it is necessary to establish strong institutional arrangements to surmount local and regional jurisdictional barriers. Second, it is necessary to agree on methodologies for assigning costs associated with the joint use of existing facilities on a fair and equitable basis. Finally, economic responsibility (the cost of service) must be properly assigned to customer groups. These questions are rightly asked by public utility regulators.

Ideally, from an economic standpoint a structural alternative will pass three fundamental tests: the least-cost test, the no-losers test, and the viability test. A simple representation of these tests is provided in table 4-6. In reality, of course, most alternatives do not live up to ideal standards. Policymakers must seek out solutions that are administratively feasible and that optimize results among competing policy goals. These tests, then, serve mainly as general decisionmaking tools rather than definitive criteria.

For the first test, methodologies are emerging for evaluating prospective water utility projects on the basis of least-cost, borrowing substantial from the literature in the energy field. Safe drinking water regulations complicate the analysis to the extent that comparing a stand-alone system that is out of compliance with a consolidated system that is in compliance raises an "apples-and-oranges" problem. Care should be taken to measure costs realistically and use an appropriate time frame in the analysis. A short-term jolt in costs, for example, might be offset by long-term system economies associated with an expanded customer base.

Whether a structural alternative meets the least-cost test may depend on whether economies of scale can be realized in changing the structural relationship between two utilities (such as through a merger). While in general, it is presumed that the water utility industry can benefit through consolidation, economies of scale achievable through physical extension of facilities are limited. A computer simulation model can facilitate the analysis of tradeoffs made in hydraulic interconnection. An early application of this type of analysis was made by Robert M. Clark, who showed how unit costs vary over the service area with respect to the distance water must be transmitted.[47] Clark found that unit costs decreased

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46 Johnstone (1985) as cited in Prasifka, *Current Trends*, 20.

47 Clark, "Minimizing Water Supply Costs," 69.

TABLE 4-6
THREE TESTS FOR ANALYZING STRUCTURAL CHANGES

Least-Cost Test

Desirable Outcomes

Total cost of Utility AB is less than (<)
Total cost of Utility A plus (+)
Total cost of Utility B.

Where Utility AB is a restructured relationship between Utility A and Utility B and total cost reflects all costs necessary to have both systems in compliance with all appropriate regulations.

Undesirable Outomes

Any restructured relationship between Utility A and Utility B resulting in a higher total cost than the sum of their total stand-alone costs.

No-Losers Test

Costs to Ratepayers of Utility A	Costs to Ratepayers of Utility B	Outcome
No change	No change	Desirable
Decrease	No change	Desirable
No change	Decrease	Desirable
Decrease	Decrease	Desirable
Increase	Increase	Undesirable
Increase	No change	Undesirable
No change	Increase	Undesirable

Viability Test

Desirable Outcomes

Strong utility + strong utility = strong utility.
Strong utility + weak utility = strong utility.
Weak utility + weak utility = strong utility.

Undesirable Outcomes

Any structural change resulting in a utility (or utilities) weaker or less viable than before.

Source: Authors' construct.

until about the seven-mile or eight-mile point, suggesting that systems extending beyond this point may not be achieving least-cost goals. According to Clark:

> This [finding] demonstrates that a minimum unit cost of supply exists in relation to distance. The implication for regional water supply is that economies of market area gained by a centralized plant dissipate in the transmission/distribution system at approximately 7-8 miles from the plant. After than point, unit costs continue to rise. Therefore, regionalization of water utilities may not be a priori justified by the economies of scale argument. It depends on how close the respective utilities are, as well as the difference between marginal costs of all-on treatment technologies and the additional costs of the transmission/ distribution system expanded to link the utilities.[48]

Water utility managers and regulators interested in consolidation options would be well advised to replicate this type of analysis for their own circumstances and with current cost data. Noneconomic hydraulic interconnection should be avoided in favor of other forms of consolidation (such as satellite management) where other economies may be readily achievable. Limits to economies of scale suggest that small and middle-sized water systems may continue to have a role in the provision of water service. However, in accordance with least-cost goals, nonhydraulic forms of consolidation may affect their role in dramatic ways.

The second test, the no-losers test, emphasizes analyzing structural changes in terms of how all ratepayers might be affected by a structural change in the way water service is provided. In an acquisition, for example, the rates of the acquiring and the acquired utilities both may change. If costs rise and rates are equalized for all customers (as for the Connecticut Water Company), one group of ratepayers (usually core customers) may end up subsidizing another group (usually satellite customers). This raises questions of equity (as well as perceptions about equity) on the part of ratepayers. Thus even when such subsidies are allowed, utilities and regulators should be prepared to defend them in terms of the policy benefits that they are expected to yield. The no-losers test is the easiest test to fail and can be especially political. However, policymakers may sacrifice no-losers goals in favor of achieving least-cost and viability goals as well as broader public interest goals. They also might be inclined to give up a strict no-losers policy if the losers lose little relative to the gains made on the whole.

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48 Ibid.

The third test to consider is a viability test. Unfortunately, some structural alternatives may pass the least-cost or no-losers tests but not the viability test, or vice versa. Rate equalization, for example, creates winners and losers but also tends to enhance viability. Depending on the magnitude of the costs and the number of customers involved, changing the structural relationships among utilities can have different viability outcomes. A merger of two weak or nonviable utilities might result in a stronger, more viable utility (which requires only one treatment operator, one billing department, and so on). However, it is possible to restructure the relationship between two weak utilities or a weak and a strong utility and end up with a weak utility. Satellite management and mandatory takeovers frequently raise this concern. In considering any structural change, implications for technical, financial, and managerial performance in relation to the viability of the utility (or utilities) involved should be examined. Methodologies for assessing performance along these dimensions are examined in chapters 5 and 6 of this report.

Even when structural alternatives promise positive outcomes, this may not be incentive enough for utilities to engage in restructuring activities, particularly if institutional barriers to implementation exist. Some states are beginning to design incentives for restructuring that operate through various regulatory and assistance programs. A form of incentive can be implemented through state funding programs. One of the criteria for identifying priority projects for funding by PENNVEST, for example, is "Whether the project encourages consolidation of water or sewer systems, where such consolidation would enable the customers of the systems to be more effectively and efficiently served."[49] More recently, Pennsylvania also established a small water system assistance program, including a grant program "for the purpose of making grants to local sponsors in order to assist small water systems with the cost of feasibility studies for the development of regionalized water systems."[50]

Certain ratemaking methods (such as acquisition adjustments) can provide restructuring incentives. Most larger water utilities would argue that they should be rewarded with an acquisition adjustment for taking on the added risk and

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49 "Eligibility and Priority Criteria from Section 10 of the Pennsylvania Infrastructure Investment authority Act," as reported in Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), 9-5 and 9-6.

50 *Pennsylvania House Bill No., 1403,* Session of 1991, passed March 16, 1992.

responsibility that comes with absorbing a troubled water system. Many regulators, however, regard acquisition adjustments as inconsistent with traditional ratemaking practices. When acquiring troubled systems, the water utilities also would like to have flexibility in meeting other regulatory requirements of the jurisdiction in which they operate, such as metering of all connections.[51] In decreasing order of benefits to the acquiring utility's investors are methods dealing with acquisitions:[52]

- Full amortization of the excess acquisition cost and inclusion of the unamortized balance in the rate base.
- Various mixes of rate base inclusion and amortization of the excess acquisition cost.
- Full amortization of the excess acquisition cost coupled with rate base exclusion of the unamortized balance.
- Partial amortization of the excess acquisition cost coupled with rate base exclusion.
- Treatment of the excess acquisition cost as a current expense (thus affecting current revenue requirements only).
- No amortization of the excess acquisition cost and rate base exclusion but allowance of a higher than market-justified rate of return.
- Inclusion of the excess acquisition cost in the rate base coupled with delayed recovery of capital (that is, phase in).
- No amortization of the excess acquisition cost and rate base exclusion (that is, complete disallowance).

The more favorable the ratemaking treatment to the acquiring utility, the stronger the incentive to acquire small water systems. Selecting a treatment is a matter of public policy that in some cases may go beyond traditional boundaries of regulatory policy in the interest of achieving long-term policy goals. Again, the implications of the treatment for achieving least-cost, viability, and no-losers goals should be assessed.

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51 William D. Holmes, "The Take Over of Troubled Water Companies," 371-76.

52 Patrick C. Mann, G. Richard Dreese, and Miriam A. Tucker, *Commission Regulation of Small Water Utilities: Mergers and Acquisitions* (Columbus, OH: The National Regulatory Research Institute, 1986).

In addition to these issues, other ratemaking incentives are available for use by the commissions, including higher rates of return in recognition of increased risks. Using these tools, regulators can induce some utilities into activities they otherwise might not undertake by making it worthwhile to do so. In some cases, "building goodwill" with regulators can be incentive enough. A utility's efforts to improve the overall viability of the industry (for example, through satellite management) might be viewed positively by regulators who share this policy goal.

Perhaps most difficult to grasp, and certainly most difficult to quantify, is the role of local politics in implementing structural solutions. Regionalization may make economic sense but many small communities may not want to sacrifice control of their water system to an "outside" entity.[53] Control of the water system may be tied politically to other aspects of local control, such as schools and public safety services. A community may believe that giving up control of the water system is a precursor to loss of control elsewhere. For some municipal water systems, revenues may be used to subsidize other city services. The system might even provide service outside its boundaries at rates higher than within city limits as another way to supplement revenues.

It follows, according to one study, that the states will continue to play an essential role in the policies emphasizing consolidation or regionalization of water supply, one that surpasses the federal and local roles:

> The benefits of regionalizing water services are widely recognized. Because federal intervention is not likely to be looked upon favorably and because local efforts can be expected only among a few of the major population centers, the impetus for regionalization as a means of addressing the difficulties created by the fragmentation of water services in the United States must remain with the states. Several states have already begun to take important initiatives, and professionals in the water supply sector must continue working with local and state officials to create a climate where regionalization efforts can prosper.[54]

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[53] Issues of local control and autonomy also arise in public utility areas, such as the provision of 911 emergency telephone service.

[54] Daniel A. Okun, "State Initiatives for Regionalization," *American Water Works Association Journal* 73 (May 1981): 245.

In the very long term, as in the case of emerging water systems, structural policies toward existing systems are dependent on the development of a more comprehensive policy framework.

Comprehensive Policies

Comprehensive planning for new water systems, as discussed in the previous chapter, naturally correlates with planning by and for existing water systems. As in the case of emerging systems, small water systems themselves cannot bear the full burden of comprehensive planning. As previous NRRI research has emphasized, integrated planning principles can be adapted to the needs of small systems and a truly integrated planning approach will take the needs of these systems into account.[55] This includes planning by government agencies and even planning by larger water systems. Furthermore, even small systems should have the capability to prepare a basic business plan.[56]

The U.S. Environmental Protection Agency has recognized the importance of planning in improving the viability of the water supply industry while also recognizing the role of existing systems in meeting future needs:

> Water supply planning is recognized as a means of addressing current and future problems. It allows the identification of all regulated water systems in a given area and the determination of how best to coordinate future development. Planning facilitates interconnections and satellite operations by detailing the future expansion plans and capabilities of existing water systems.[57]

Early state initiatives promoting planning and consolidation for water supply include North Carolina's Regional Water Supply and Sewage Disposal Planning Acts

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[55] Janice A. Beecher, James R. Landers, and Patrick C. Mann, *Integrated Resource Planning for Water Utilities* (Columbus, OH: The National Regulatory Research Institute, 1991).

[56] Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991).

[57] U.S. Environmental Protection Agency, *Developing Solutions: On the Road to Unraveling the Small Systems Dilemma* (Bulletin no. 1, July 1990), 1.

(1971) and Washington's Public Water System Coordination Act (1977).[58] One of the most recent initiatives, passed in March 1992, is Pennsylvania's House Bill No. 1403, which establishes an assistance program including state grants for "comprehensive small water systems regionalization studies."

Growing interest integrated planning also is demonstrated by the development of memoranda of understanding among various governmental agencies involved in water system regulation, as mentioned in the previous chapter. California took the lead in this area in early 1987. In 1991, the Florida Public Service Commission entered into a comprehensive memorandum of understanding with the state's water management districts; a memorandum between the commission and the Department of Environmental Regulation is in draft form. These agreements serve to coordinate not only certification of new systems but ongoing regulation of existing systems.

In Connecticut, 1985 legislation ("An Act Concerning a Connecticut Plan for Public Water Supply Coordination") provided for coordination of long-term water supply planning by the state's Department of Health Services.[59] The state has been divided into seven areas each with a Water Utility Coordinating Committee to facilitate the planning process, which includes public and private water utilities and regional planning organizations. A key part of the strategy is to define the boundaries of exclusive service territories as well as new rights and responsibilities for the water utilities operating within them. Regulations under the act call for supply development, main extension, and satellite management of noninterconnected systems within the exclusive service area.

The state of Washington engages in a comprehensive water system planning process, as summarized in table 4-7. In 1985, state drinking water regulators developed a detailed handbook to guide water systems through the state-mandated planning process.[60] Recently published guidelines make it possible for even the smallest systems in the state (serving 100 to 999 services) to participate in the planning process. Another recent development is the emphasis on coordination between the Department of Health and the Utilities and Transportation Commission in regulation and planning for water utilities.

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58 Okun, "State Initiatives for Regionalization," 243-45.

59 McQueen, "Takeover of Small Failing Water Systems," 341.

60 Alan Rowe and Richard Siffert, *Planning Handbook: A Guide for Preparing Water System Plans* (Olympia, WA: Department of Social and Health Services, 1985).

TABLE 4-7
WASHINGTON STATE'S
COMPREHENSIVE WATER SUPPLY PLANNING PROCESS

Preliminary Assessment

1. Existing water systems

   a. History of water quality, reliability, service
   b. Fire fighting capability
   c. Evaluation of facilities

2. Future water sources

   a. Availability
   b. Adequacy

3. Service area boundaries

   a. Map of established boundaries
   b. Identification of systems without boundaries

4. Growth in the area

   a. Current population and land use patterns
   b. Population and land use trends

5. Status of planning

   a. Water system
   b. Land use
   c. Coordination

Individual Water System Plans

1. Basic Planning Data

   a. Service area description
   b. History of system (planning, sources, etc.)
   c. Present and future land use
   d. Present and future population
   e. Present and future water use

2. Inventory of Existing Facilities

   a. Description of existing sources and system facilities
   b. Hydraulic analysis
   c. Water quality and conformance with standards
   d. Fire fighting capability and conformance with standards

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TABLE 4-7 (continued)

Individual Water System Plans (continued)

3. System improvements

    a. Projection of 10-year water demand
    b. Describe alternatives to meet demand (and cost)
    c. Selection and justification of alternative
    d. Schedule of improvements
    e. Financial program

4. Other topics

    a. Watershed control program
    b. Service area agreements
    c. Analysis of shared facilities (interties, reservoirs)
    d. Relation between water and land use plans
    e. Operations program
    f. Consideration of State Environmental Policy Act
    g. Maps supporting the plan

Area-Wide Supplement

1. Assessment of related plans and policies
2. Future service areas in the region
3. Minimum areawide design standards
4. Process for authorizing new water systems
5. Future areawide source plans (supporting studies, reservation)
6. Plans for development of joint use or regional facilities
7. Application of satellite support systems
8. Other topics pertaining to the region
9. Compatibility of supplement with other plans and policies
10. Continuing role of Water Utility Coordinating Committee
11. Consideration of State Environmental Policy Act

Source: Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), 3-4 and 3-5.

Long-term consolidation of the water supply industry may require some rather invasive government policies, such as the takeover of water systems by public agencies. However, this is not to say that major industry restructuring cannot be accomplished in the long term through private sector initiatives, as through voluntary mergers and acquisitions. The experience of the Indianapolis Water Company (IWC), which in its origins served 1,300 customers and today serves more than 750,000, is a case in point:

> Investor-owned IWC, in its one-hundredth year of public water service, has become a regional utility serving both incorporated and unincorporated areas of four counties in central Indiana. Through careful planning in the areas of management, finance, and engineering, the company continues to offer new regional water service by marketing main extensions, developing satellite supply and distribution systems, and acquiring existing utilities.[61]

Thus in contemplating regulatory, structural, and comprehensive policies for the water supply sector, it is probably best to keep an open mind about institutional alternatives. In fact, institutional diversity is probably desirable because it allows for experimentation, comparison, and competition among specific options, all of which should enhance viability in the long term.

Ideally, comprehensive, integrated planning by the states will involve not only drinking water authorities and public utility commissions, but also water resource agencies and others with an interest in water. State natural resource departments, for example, may have substantial permitting and planning authority as well as a strong interest in improving coordination among suppliers. Given the growing concern about environmental issues, other branches of government (such as legislatures and governors' offices) can be expected to launch their own water resource planning initiatives. Beyond the states, planning and coordination also occur at a regional level, through river basin agreements and compacts. All of these policies may influence the industry's restructuring and the future role of small water systems. Regulators can help assure that planning by jurisdictional water systems comports with the provisions of these other planning processes in addition to least-cost and other utility planning principles.

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61 J. Darrell Bakken, "Evolution of a Regional System," *Journal of the American Water Works Association* 73 (May 1981): 238-42.

CHAPTER 5

WATER SYSTEM PERFORMANCE ASSESSMENT

In light of the growing interest in viability policies for both emerging and existing water systems, the need for performance assessment techniques also has grown. Today, water utilities, their regulators, and others concerned about viability can apply a variety of rudimentary assessment techniques to evaluate or "screen" water utilities. Utilities themselves may use these techniques to appraise their own condition or that of another utility with which they might want to do business. Regulators may use the same techniques to evaluate certificate applications, survey the health of existing utilities, or to trigger intervention. Public policy analysts may use them to measure the effectiveness of policies designed to improve water system viability.

Assessment techniques vary in the amount of resources they require, the degree to which they involve quantitative and qualitative evaluation methods, and their capacity to predict whether a water system will become nonviable. Such distinctions are important. First, the issue of resources arises in the context of the debate over the appropriate role of government in general, and water regulators in particular, when it comes to assuring water system viability. To most regulators, issuing (and maintaining) a certificate of need carries with it some responsibility to ensure that the certified entity is actually capable of providing the service in question. But how much should a government spend in monitoring and assessing water system viability? Resources spent in this endeavor cannot be used elsewhere in regulation or state government. Thus regulators may choose techniques requiring the level of resources they determine to be appropriate.

Second, many emerging assessment methods (including the approach presented in chapter 6) lean toward the quantification of viability. Quantification does not necessarily make a method more accurate, precise, or reliable. Such methods can ignore some of the more qualitative aspects of performance, such as management competence, which require judgment on the part of the evaluator. Certain viable systems may fail a poorly constructed quantitative test, while certain nonviable systems may pass. However, there are efficiency advantages in using certain quantitative methods because they reduce the resource demands mentioned above.

Also, quantitative methods provide a degree of objectivity and may be particularly useful in establishing basic threshold levels. Systems falling below the chosen threshold are good candidates for further assessment, including the application of qualitative evaluation methods.

Finally, the art of water utility performance measurement and assessment is new and not well established. What is needed is further application of the methods so that appropriate refinements can be made. However rough it may be, performance assessment is a logical next step in developing viability policies. To aid in performance measurement and assessment, a select group of techniques is presented here. Most can be adapted readily for use in evaluating new or existing water systems and methods can be combined to suit the needs of individual jurisdictions. Several states already have incorporated assessment in their certification and other water system policies. Connecticut, for example, has a comprehensive certification policy and its regulatory agencies conduct many of the background checks necessary for ensuring viability.[1] This chapter briefly reviews some general methods before turning to a more detailed study of failure prediction modeling in the following chapter.

Performance Assessment in Banking

As noted earlier in this report, the banking industry provides a useful perspective on water utilities, particularly with regard to screening new firms for potential problems in viability. The failure rate of new banks in general is extremely low, suggesting that the requirements for new bank charters may provide a source of information for other regulators seeking to improve their certification processes. Although in recent years the integrity of the banking industry has drawn considerable fire, it can be observed that it was not necessarily the performance assessment methods that failed but the policy process that should have ensured their judicious use.

Applications for new banks can go to the Office of the Comptroller of the Currency (OCC) or to state bank commissions. All applicants must seek deposit insurance so the applicants also must file an application to the Federal Deposition

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[1] Larry Morandi and B. Foster, *Compliance with the Safe Drinking Water Act: State Legislative Options* (Denver, CO: National Conference of State Legislators, 1990).

Insurance Corporation (FDIC) regardless of whether they are seeking a federal charter or a state charter. Evaluation methods by the OCC and FDIC are based on statutory requirements and are similar for both agencies. In analyzing applications the Comptroller is guided by "decision factors" listed in its *Manual* as follows:[2]

- The bank's future earning prospects.
- The general character of the bank's management.
- The adequacy of the bank's capital structure.
- The convenience and needs of the community to be served by the bank.
- The bank's compliance with the National Bank Act and Federal Deposit Insurance Act.

The Comptroller's *Manual* also clearly points out that for survival, a new bank should have a growing economic market area and be shielded from potentially destructive competition.[3] Especially in a stagnant market area the presence of too many banks is considered unhealthy. Thus charters are seldom, if ever, approved in a weak economic area. The OCC *Manual* goes on to state that "operating plan assumptions about the market must be reasonable and projections must be consistent."[4] The FDIC has similar requirements that are thoroughly discussed in its application packet of information which contains 600 pages of instructions.[5] The major requirements are summarized in table 5-1. It is apparent that banking regulators look upon economic growth and the quality of management as the key predictors of success for a new bank. These factors also are essential for the success of any new firm.

Bank chartering agencies and the FDIC also require new firms to file a business plan, much like those filed by new firms applying to a bank for a line of

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[2] Office of the Comptroller of the Currency, *Comptroller's Manual for Corporate Activities*, Section 2.1, Charters, Washington, DC: December 1988.

[3] In essence, the new bank should have a monopoly with only nondestructive competition.

[4] Ibid., 4.

[5] *FDIC Rules and Regulations: Statement of Policy*, Washington, DC: 3-31-83 (December 31, 1989) 5086+, Section C.

TABLE 5-1

FDIC FINANCIAL REQUIREMENTS FOR BANK CERTIFICATION

Financial history and condition	Restricts investment in fixed assets, leases, insider transactions, and sets accounting standards.
Adequacy of capital structure	Requires that initial and unimpaired capital should be equal to at least 10% of estimated assets at the end of the third year of operation.
Future earnings prospects	Requires reasonable and supportable estimates that within a reasonable time (normally 3 years) break-even will occur and a reasonable profit will be earned.
General character of the management	States that the quality of a bank's management is vital and is perhaps the single most important element in determining the applicant's acceptability for deposit insurance. A detailed evaluation procedure is set out by the FDIC for measuring the management's qualifications.
Convenience and needs of the community to be served	Requires massive amounts of economic, demographic, competitive, and other supporting data and projections and trends for the future for presentation to the FDIC.

Source: *FDIC Rules and Regulations: Statement of Policy,* Washington, DC: 3-31-83 (December 31, 1989) 5086 et seq., Section C.

(a) See page 5088 of the source.
(b) Recall that the OCC study *Bank Failure* (1986) determined that poor management was the single most important cause of bank failure, and a similar finding was presented in Pantalone and Platt (1987).

credit or loan. Business planning forces entrepreneurs to isolate the important economic, social, demographic, and even political factors that will affect the new firm positively or negatively. Projections of these factors must be made for several years into the future to determine the "break even" year for the firm and its earnings potential.

New water companies frequently spring up in new housing developments after the homes are built and the development stabilizes. This implies that the growth phase has passed and slow growth (at best) will occur in new hook-ups and per capita consumption. Per capita water demand does not increase in the United States very much, even for large and financially successful water utilities. Once a development is completed small water utilities must rely on relatively constant revenue flows and regular inflation-induced increases in operating costs. Thus potential earnings growth, so essential for new banks, often is lacking for new water companies.

The analogy of banking to the water industry is instructive but imperfect. Both are regulated industries, to be sure, and both face viability challenges. However, when a bank fails, an existing bank can assume its services. Customer can even conduct their banking through the mail with almost any bank. If a water system fails, the available substitutes are limited. Well water can be costly and may not meet community drinking water standards; bottled water also is costly and is not practical for uses other than drinking. The failure of a public utility can cause considerable hardship on the customers to which the utility was obligated to serve.

Thus it can be argued that applicants for water utility certificates could be subjected to at least the same rigorous requirements of new bank applicants, as set forth in table 5-1. For emerging water systems, a business plan approach has been advocated by Wade Miller Associates, Inc., as discussed below.[6] For existing systems, some variations on the banking model already are being applied, not surprisingly, under state loan programs targeted at small water systems. As reported in table 5-2, Pennsylvania's PENNVEST loan program consists of a fairly rigorous screening process, which helps assure system viability as well as loan repayment.

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[6] Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991).

TABLE 5-2

PENNVEST APPLICATION PROCESS

Viability Screening Elements	Steps
(None)	Applicant arranges planning consultation with Department of Environmental Resources (DER) engineer.
Review/Discussion of Project Alternatives	Planning consultation meeting with DER engineer.
Analysis of Alternatives and Cost-Effectiveness	DER engineer prepares planning consultation and prefeasibility assessment report; transmits to applicant.
Analysis of Alternatives and Cost-Effectiveness	Applicant prepares planning and feasibility report; submits to engineer.
Analysis of Alternatives and Cost-Effectiveness	Preapplication conference with DER engineer to review planning and feasibility report.
Statement of Income and Expenses, Debt History, Demographic Data	Submission of application for financial assistance.
Credit Analyses; Assurances of Need and Ability to Pay	Review of application and decision.

Source: Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), 9-3.

Under current economic conditions regulators must be especially skeptical about the future of emerging water systems and nonviable existing systems and want to use appropriate assessment methods in determining their fate.

Performance Assessment Methods

For those interested, a variety of water system performance assessment methods is available. Most can be adapted to the needs of the user. As noted above, these methods vary in complexity and in the resources required to use them. Some regulatory commissions, for example, may want to invest additional resources in performance assessment if they believe the cost of doing so will be made up later in improved regulatory compliance. In other words, dollars invested in assessment and early intervention could save regulators from the expense of enforcement actions down the road.

The three-legged stool of water system performance--technical, financial, and managerial--provides a basic guideline for performance assessment by water utilities and their regulators, as seen in table 5-3.[7] Specific tools and applications are available for assessment within each of these areas, although they sometimes overlap. In more comprehensive policies, such as integrated resource planning, attention is paid to all three legs of the stool simultaneously in recognition that all three are necessary for water system viability.

Technical Performance

In chapter 1, along with identifying the dimensions of water system performance, some basic technical questions asked were: Can the system provide safe, adequate, and reliable water service? Does the system comply with drinking water regulations? Does the system operate with engineering efficiency? Is the system technologically current? Is the system run by a certified operator?

For specific evaluation guidelines on technical performance in relation to drinking water quality, deference to the state drinking water agencies generally is

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[7] For a similar classification, see Kearney: Management Consultants, *Management Audit Manual for the Utility Industry* (not dated).

TABLE 5-3

SAMPLE UTILITY AND REGULATORY USES OF WATER SYSTEM PERFORMANCE ASSESSMENT

Area of Concern	Sample of Uses by Water Utilities	Sample of Uses by Regulatory Agencies
Technical	Use in-house expertise, nearby utilities, regulatory agencies, professional associations, and other resources to monitor and evaluate technical performance.	Evaluate technical needs and capabilities of emerging and existing water systems (state drinking water agencies in cooperation with other agencies).
Financial	Assess financial condition using standardized worksheets; meet financial reporting requirements; maintain accurate and reliable records.	Assess financial condition of emerging and existing water systems; review financial reports; conduct financial audits as needed; use methods that trigger other regulatory actions (state public utility commissions in cooperation with other agencies).
Managerial	Prepare a comprehensive business plan with an emphasis on management capabilities and practices; use outside resources for assistance.	Conduct a management audit or simplified assessment of management capabilities capabilities; monitor compliance with reporting requirements.

Source: Authors' construct.

appropriate. These agencies have responsibility for implementing federal standards under the Safe Drinking Water Act (SDWA), including monitoring and enforcement. The SDWA and the rules for its implementation spell in great detail unacceptable levels of contamination and reporting requirements for systems. As seen in chapter 2, the U.S. Environmental Protection Agency spends considerable effort amassing data on compliance with the SDWA. It should not be necessary for the technical staff of the public utility commissions to duplicate the efforts of state drinking water agencies when commission staff time is better spent on other technical and policy issues related to economic regulation.

While the utility commissions may need to defer to their sister agencies on certain technical matters, they can provide a system of checks and balances to help assure that technical performance standards are met. In rate cases and other proceedings, for example, commissions could require that the record include a statement from drinking water regulators that the system is in compliance. Where costs associated with the SDWA are reviewed, agency coordination on technical issues is especially important. This information, for example, may have a direct bearing on a commission's determining whether or not a proposed facility will be "used and useful" or if a proposed investment is "prudent." The technical expertise of commission staff also can be applied in the evaluation of water system programs in such areas as drought or emergency planning, leak detection and repair, corrosion control, cross-connections, and water source protection and preservation.

Finally, consistent with integrated planning principles, both utility commissions and drinking water regulators can use planning processes to improve technical performance. Planning guidelines are available for this purpose.[8] Borrowing from the Pennsylvania proposal, a simple approach is to require a facilities plan for emerging and existing systems, as described in table 5-4. The capacity of water systems to prepare a workable facilities plan can be used as a viability screening device. For emerging systems, approval of a facilities plan by the various state regulatory agencies can be a prerequisite to certification. As seen in the table,

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[8] See Tennessee Department of Health and Environment, *Local Drought Management Planning Guide for Public Water Suppliers* (Nashville, TN: Office of Water Management, Tennessee Department of Health and Environment Office of Water Management, 1988).

TABLE 5-4

TECHNICAL ASSESSMENT OF WATER SYSTEM VIABILITY USING A FACILITIES PLAN

For emerging water systems, the facilities plan:

- Describes the facilities to be constructed, including a description of the phasing of construction and future plans for expansion;
- Incorporates a forward-looking assessment of SDWA compliance requirements based on monitoring data from proposed source of supply; and
- Describes the alternatives considered and the rationale for the selected approach to providing water service.

For existing water systems, the facilities plan:

- Provides an evaluation of the condition of existing facilities and an inventory of needs for rehabilitation and replacement;
- Provides a forecast of needs for system expansion;
- Provides a forward-looking assessment of SDWA compliance requirements based on monitoring for unregulated contaminants; and
- Presents an analysis of alternative approaches to providing water service, including absorption via interconnection into a neighboring system; purchased water arrangements; alternative ownership and management arrangements; and satellite management arrangements of various types.

Source: Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), 6-3.

these plans can go well beyond traditional technical considerations. Facilities planning can be used to assess structural alternatives for water systems as well. Insome cases, the best *technical* solution may be a *structural* one that changes the very character of the water service (such as a change in utility ownership).

Financial Performance

In chapter 1, financial performance questions were: Does the system have or can it acquire the capital needed to provide water service that meets regulatory standards? Do the existing or proposed rates accurately, adequately, and equitably reflect the full cost of water service? Are the system's customers willing and able to pay the rates necessary for the provision of water service?

Understandably, water system viability frequently is defined in financial terms. Technical and managerial performance depend heavily on the financial performance of any firm, and water utilities are no exception. Financial performance assessment methods range from simple (a checklist approach) to complex (regression-based risk analysis), as discussed below. The following chapter sets out a more detailed financial assessment method focused on the issue of failure prediction. The methods discussed here are budgetary analysis, financial indicator analysis, financial ratio analysis, risk analysis, and demographic analysis.

Budgetary Analysis

The U.S. Environmental Protection Agency, in the interest of improving compliance with federal drinking water standards and building a more viable water supply industry, has prepared several resources that utilities can use to assess their financial well-being. For very small systems, some fairly simple methods are available. One method is a basic comparison of a utility's *budgeted* revenues with its *realized* revenues.[9] Using a simple spreadsheet, a utility can monitor its revenues from rates, fees, and other user charges (and, for public utilities, taxes and other revenues sources) on a monthly basis. Budgeted amounts are compared to dollars received on a year-to-date basis. In this way, a potential shortfall is recognized early enough for the utility manager to take action.

Recently, regulators in Washington state have begun to develop a budgetary approach for assessing water system financial viability.[10] A draft of their model,

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9 Paul L. Shinn, Steven Turtil, Benjamin Mays, and Haig Farmer, *A Water and Wastewater Manager's Guide for Staying Financially Healthy* (Washington, DC: U.S. Environmental Protection Agency, 1989), (brochure).

10 Washington State Department of Health and U.S. Environmental Protection Agency, *Financial Manual for Small Water Utilities* (Draft dated October 1991).

TABLE 5-5
WASHINGTON STATE'S PROPOSED FINANCIAL VIABILITY ASSESSMENT TEST FOR SMALL WATER SYSTEMS

	BUDGET BASIS FOR YEAR 1	CALCULATION
TEST 1		
1. REVENUE		
2. Water rates	$_____	From worksheet
3. Total other revenue	_____	From worksheet
4. TOTAL REVENUE	$_____	Add lines 2 - 3
5. EXPENSES		
6. Total C&M and A&G expenses	$_____	From worksheet
7. Taxes (property, B&O)	_____	From worksheet
8. Debt service payments	_____	From worksheet
9. Net CIP from rates	_____	From worksheet
10. Operating cash reserve(increase)	_____	From worksheet
11. Capital cash reserve(increase)	_____	From worksheet
12. TOTAL EXPENSES	$_____	Add lines 6 - 11
13. Required water rates	$_____	Total expenses less other revenue
14. Is line 2 = > than line 13	$_____	Yes or no. If no, go back and raise rates or reduce expenses
TEST 2		
15. Current operating cash reserve	$_____	Separate operating cash from your bank statement
16. Budgeted increase	_____	Line 10
17. Total operating cash reserve funds	$_____	Line 15 + 16
18. Required operating cash reserve	$_____	Line 6 X 0.125 (see note below)
19. Is line 17 = > line 13	$_____	Yes or no. If no, continue to budget annual increases in operating budget
TEST 3		
20. Current capital cash reserve	$_____	Separate capital cash reserve From your bank statement
21. Budgeted increase	_____	Line 11
22. Total capital cash reserve funds	$_____	Line 20 + 21
23. Cost of replacing supply or critical mechanical equipment	$_____	Current replacement cost
24. Is line 22 = > than line 23	_____	Yes or no. If no, continue to budget annual increases in operating budget

TABLE 5-5 (continued)

<u>TEST 4</u>

25. Median household income	$_____	Line 29
26. Median household income X .015	_____	Line 25 X .015
27. Cost/equivalent residential units (ERU)	$_____	Line 13/Line 30 or 31
28. Is line 26 = > than line 27	_____	Yes or no. If no, pursue other ownership options or establish improvement implementation schedule
<u>Customer Data</u>		
29. Median household income	$_____	From Washington State Department of Health
30. Total # of equivalent residential units (ERU) method 1 -	_____	From your customer records
31. Total # of equivalent residential units (ERU) method 2 -	_____	Utility annual water use/ (average monthly household use x 12 months)

Note: (45 Days/365 Days) = 1/8 = 0.125

Source: Washington State Department of Health and U.S. Environmental Protection Agency, *Financial Manual for Small Water Utilities* (draft dated October 1991), A-1.

which also includes an ability-to-pay test, appears in table 5-5. The model consists of four tests through which the adequacy of existing revenues and reserves can be assessed:

- **Test 1:** Is a budget in place and are rates sufficient to cover expenses?
- **Test 2:** Is the operating cash reserve sufficient?
- **Test 3:** Is the capital cash reserve sufficient to cover the cost of replacing source of supply or critical mechanical equipment?
- **Test 4:** Is the cost of water per equivalent residential units (ERU) equal to or greater than 1.5 percent of median household income?

As seen in table 5-5, the calculations for this type of assessment actually are fairly simple. Additional worksheets provide an opportunity for utilities to develop detailed five-year budget data that are fed into the overall assessment model. The model is especially useful in making a general assessment of the adequacy of existing rate revenues. A side benefit of budgetary analysis is that it forces utilities to maintain accurate and reliable data.

Financial Indicator Analysis

Beyond a budgetary analysis, utilities and regulators can conduct a more detailed assessment of financial performance using a variety of indicators. Clearly, there is no shortage of general financial performance indicators for utilities, as seen in table 5-6. These indicators are more comprehensive and can be used not only to evaluate financial conditions but management performance. A thorough financial report or audit of a public utility could make use of all of these indicators and probably more. For many states, auditing every jurisdictional water utility would be virtually impossible. However, an audit framework can be used to design annual utility reports, make data requests in the course of rate case and other regulatory proceedings, and for general evaluation purposes. Water utilities should monitor these financial performance indicators for self-evaluation purposes. Time series data are particularly helpful. Early identification of a downward trend can provide an opportunity for intervention.

Financial Ratio Analysis

Financial ratios (many of which also are key financial indicators discussed above) constitute one of the leading methods of financial performance assessment for all types of businesses. Dun & Bradstreet Credit Services, for example, are renowned for their use of financial ratio analysis.[11] Their key ratios are summarized in table 5-7 and described in detail in appendix E.

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11 Dun & Bradstreet Credit Services, *Industry Norms & Key Business Ratios, One Year Edition 1988-89* (New York: Dun & Bradstreet, 1989).

TABLE 5-6

GENERAL FINANCIAL PERFORMANCE INDICATORS FOR PUBLIC UTILITIES

- Operating ratios
- Return (net plant; assets; long-term capitalization; stockholders equity)
- Rates of growth (earnings per share; dividends)
- Capitalization ratio
- Bond ratings
- Interest coverage
- Internal generation of funds
- Depreciation (as percent of revenues; as percent of plant)
- Tax deferrals as percent of revenues
- Generation of funds from internal sources to meet total needs (employee stock plans; dividend reinvestment)
- Return on pension plan (return versus external measures, i.e., S&P 500, Kuhn Loebs Index; return versus actuarial requirement)
- Accounts receivable (days in accounts receivable; aging by customer grouping; bad debt as percent of collections)
- Delinquency experience (write-offs as percent of revenues; cut-off notices; disconnects; agency collections)
- Cash management (days invested in cash; number of bank accounts and average daily balances; time between meter readings and billings; short-term borrowing by type and rates)
- Rate filings and results

Source: Kearney: Management Consultants, *Management Audit Manual for the Utility Industry* (not dated).

TABLE 5-7

DUN & BRADSTREET FINANCIAL RATIOS FOR FIRMS

Solvency

- Quick ratio (cash plus accounts receivable/current liabilities)
- Current ratio (assets/liabilities)
- Current liabilities to net worth
- Current liabilities to inventory
- Total liabilities to net worth
- Fixed assets to net worth

Efficiency

- Collection period
- Net sales to inventory
- Asset to sales
- Sales to net working capital
- Accounts payable to sales

Profitability

- Return on sales (profit margin)
- Return on assets
- Return on net worth (return on equity)

Source: Dun & Bradstreet Credit Services, *Industry Norms & Key Business Ratios, One Year Edition 1988-89* (New York: Dun & Bradstreet, 1989), v-vi. For complete descriptions see appendix E.

Utility managers can and should evaluate their system's key financial ratios on a periodic basis. The U.S. Environmental Protection Agency provides guidelines for doing so:[12]

- Check the operating ratio every month (using twelve months of data) and compare it to past values, it will show you the trend of finances for your utility. To calculate the ratio, divide the total revenues by the total operating expenses.

[12] Paul L. Shinn, Steven Turtil, Benjamin Mays, and Haig Farmer, *A Water and Wastewater Manager's Guide for Staying Financially Healthy* (Washington, DC: U.S. Environmental Protection Agency, brochure, 1989).

- Use historical accounting data, separate water and wastewater records, and use a worksheet.

- Revenues for a financially self-sufficient utility are mainly obtained from user service charges, but they often include other charges for special services. .Interest earnings are counted as revenues.

- Operating expenses are the costs associated with providing and maintaining the utility's services. Examples are wages and benefits for employees, administrative overhead, chemicals and electricity for treatment, parts, tools, money spent or put in reserve for routine replacement of equipment, and the principal and interest on loans or bonds.

Worksheets for three basic financial ratios--the operating ratio, the coverage ratio, and the capital investment ratio--are provided in table 5-8. With proper recordkeeping, these ratios should be fairly easy to calculate and monitor over time. In the following chapter, several key financial ratios are used in the context of a failure prediction model.

Risk Analysis

Risk analysis makes use of financial ratios and other variables in modeling business risk. The staff of the California Public Utilities Commission devised a measure of water utility risk using the standardized covariance between the rate of return for the water utility and the rate of return for an industry sample, represented by a risk factor called beta (B).[13] A higher beta for an individual water utility indicates a higher level of risk. Using multiple regression techniques, the analysts explored a variety of variables that might be associated with variations in risk; the variables that proved to be statistically significant are presented in table 5-9.[14] Class D utilities (the smallest in terms of revenues) were found to

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[13] Fassil T. Fenikile, *Staff Report on Issues Related to Small Water Utilities* (San Francisco, CA: Public Utilities Commission, 1991), 18-27.

[14] For the variables defined in table 5-9, the following risk model for Class D utilities was adopted (t-statistics appear in brackets):

$$B_i = 3.1131 - \underset{[-2.04]}{0.0463^*CGR} - \underset{[-2.55]}{2.9843^*RBTP} - \underset{[-2.79]}{0.0022^*OEPC} + \underset{[4.93]}{1.9665^*NPTOR} -$$

$$\underset{[-1.58]}{6.2404^*RORTA} + \underset{[1.67]}{1.7860^*RBGR} - \underset{[-3.31]}{1.9594^*PM} + \underset{[2.60]}{0.01251^*OMPC} - \underset{[-2.28]}{2.1689^*ROI}$$

TABLE 5-8

BASIC FINANCIAL RATIO WORKSHEETS FOR WATER AND WASTEWATER MANAGERS

Operating Ratio Worksheet		
Revenues		
User service charges	$	________
Hookup/impact fees		________
Taxes/assessments		________
Interest earnings		________
Other revenues		________
Total Revenues	$	________
Operating Expenses		
Administration	$	________
Wages		________
Benefits		________
Electricity		________
Chemicals		________
Fuel and utilities		________
Parts		________
Equipment replacement fund (municipalities)		________
Principal and interest payments		________
Depreciation (investor-owned utilities)		________
Taxes (investor-owned utilities)		________
Other		________
Total Operating Expenses	$	________
Operating Ratio		
Total Revenues	$	________ divided by
Total Operating Expenses	$	________ equals
Operating Ratio		________
Coverage Ratio Worksheet		
Total Revenues	$	________ minus
Nondebt Expenses	$	________ equals
Revenues Available for Debt Service	$	________ divided by
Debt Service Expenses	$	________ equals
Coverage Ratio		________
Capital Investment Ratio Worksheet		
Total capital outlays	$	________ divided by
Total revenue	$	________ equals
Capital investment ratio		________

Source: Adapted from Paul L. Shinn, Steven Turtil, Benjamin Mays, and Haig Farmer, *A Water and Wastewater Manager's Guide for Staying Financially Healthy* (Washington, DC: U.S. Environmental Protection Agency, brochure, 1989).

TABLE 5-9

STATISTICALLY SIGNIFICANT VARIABLES IDENTIFIED IN THE CALIFORNIA RISK ASSESSMENT MODEL

Customer Growth per Year (CGR) *Relation to risk:* Negative (-)

Operationalization. The average customer growth rate as a percentage of total number of customers.

Comment. This is intuitively expected since utilities experiencing high growth will benefit from increased revenue as a customers result of an increase in number of customers. However, the CGR benefit that customer growth has on risk is not because utilities with high growth will spend less per customer.

Ratio of Rate Base to Total Plant (RBTP) *Relation to risk:* Negative (-)

Operationalization. Rate base divided by total plant.

Comment. This was an anticipated result, confirming that risk for a utility increases with greater use of advances and contributions to fund utility plant.

Operating Expense per Customer (OEPC) *Relation to risk:* Negative (-)

Operationalization. Total operating and maintenance expense divided by total number of customers.

Comment. This is an unexpected result. One reason could be that, because utilities are regulated, higher expense translates directly into higher revenues and hence lower risk.

Net Plant Turnover Ratio (NPTOR) *Relation to risk:* Positive (+)

Operationalization. Gross operating revenue divided by net-plant (net plant is total utility plant less accumulated depreciation reserve).

Comment. This is the most statistically significant variable. A high turnover ratio could result from either a small net plant or a high gross income or both. Because the revenue requirement depends more on expenses than rate base for small utilities, the direct relation between risk and turnover ratio should be interpreted as showing the risk the utility faces on a small investment.

TABLE 5-9 (continued)

Return on Total Assets (RORTA) *Relation to risk:* Negative (-)

Operationalization. Net income divided by total assets.

Comment. The rate of return on total asset has marginal statistical significance.

Rate Base Growth (RBGR) *Relation to risk:* Positive (+)

Operationalization. Change in rate base divided by prior year's rate base.

Comment. The positive association indicates a direct and unexpected correlation between rate base growth and risk. However, because of its low statistical significance, this effect is discounted.

Profit Margin (PM) *Relation to risk:* Negative (-)

Operationalization. Operating revenue less operating expense divided by operating revenue.

Comment. A low profit margin could result from high operating expenses or lower operating revenues or both. Because we have discounted the effect of high expenses on risk, the remaining determinative factor is low operating revenues. A low operating revenue is affected by operating expenses, authorized rate of return and the size of rate base.

Operating Margin per Customer (OMPC) *Relation to risk:* Positive (+)

Operationalization. Operating revenue less operating expense divided by total number of customers.

Comment. The effect of the denominator, number of customers, is this variable and OEPC is suspect and appears to have a cancelling effect.

Return on Owner's Investment (ROI) *Relation to risk:* Negative (-)

Operationalization. Operating income divided by common equity. (No additional explanation or comments.)

Source: Adapted from Fassil T. Fenikile, *Staff Report on Issues Related to Small Water Utilities* (San Francisco, CA: Public Utilities Commission, 1991), 18-27. Based on an analysis of Class D utilities. A variable representing the average number of customers was not statistically significant.

have the highest risk factor, although Class C utilities also appear risky.[15] According to the author, other key findings were:[16]

- The net-plant turnover ratio (NPTOR) is the largest determinant of a utility's risk. The NPTOR is directly related with risk. Utilities with high turnover ratios are likely to have higher risk than those with low turnover ratios.

- The relative size of the rate base of a utility is closely related with a utility's risk. The lower the rate base to total plant (RBTP) the higher the risk and vice versa.

- Average customer size (ACS) a utility serves appeared to have no bearing on its risk. Small companies are not financially troubled just because they are small.

- Although number of customers (ACS) is not significant within a class of utilities, Class C and Class D utilities are riskier and face higher fluctuations in their earnings than Class A and Class B utilities. Economies of scale appear to exist in water companies.

- Customer growth per year (CGR) is indirectly related to utility's risk; the higher the growth rate, the lower the risk.

- The risk Class D utilities face is possibly exacerbated by a perceived unfavorable regulatory environment. This possibility is exemplified by the direct relation of years between general rate cases and risk.

Based on the model the five key determinants of small water utility risk, to which mitigative regulatory policies might be directed, are:[17]

- Small and declining rate base.

- Infrequent rate increases.

- A low authorized rate of return.

- Inadequate recovery of fixed charges.

- High operating expense per customer and low customer growth.

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15 Class A utilities have gross revenues in excess of $500,000; Class B utilities have gross revenues of $250,000 to $500,000; Class C have gross revenues from $50,000 to $250,000; and Class D utilities have gross revenues less than $50,000.

16 Fenikile, *Staff Report.*

17 Ibid., 28.

Thus a simple and preliminary risk assessment model could be designed on the basis of these five risk factors alone. Utilities facing one or perhaps two of these problems could be considered somewhat at risk, but utilities facing three or more sources of risk are probably in fairly serious trouble. While further research in this area is needed, the results of the California study provide a fairly straightforward and parsimonious model that could be replicated for other jurisdictions. More complex models of risk, of course, can be devised by adding some of the additional variables of significance.

The critical role that economic growth plays in determining risk was confirmed in the study by the Small Business Administration discussed in chapter 2, whose authors concluded that "Growth, not initial size, is the over-riding factor correlated with survival."[18] Moreover, just a little economic growth assures survival of *most* new firms: "If firms grow at all, even by adding only one employee, almost two thirds of new firms (over three out of five) will survive at least six years-regardless of initial size."[19] Absent economic growth, water utilities are more risky than the typical new firm. The economic growth variable is so important in predicting success or failure of new firms that it might be worth "weighting" in statistical models of risk.

Demographic Analysis

Finally, given the current economic climate, there is a growing interest in how the community's ability to pay (not simply willingness to pay) may ultimately determine the viability of a water system as well as other enterprises within a local economic system. This is not a normative issue of whether water rates *should* be kept affordable, but a practical one having to do with whether a local economy can sustain a water system at its full cost. It has been suggested that if water utility rates exceed 1.5 percent of median household income, the community cannot

18 Phillips and Kirchhoff, "Formation, Growth and Survival: Small Firm Dynamics in the U.S. Economy," 69.

19 Ibid.

financially sustain the cost of water service and alternatives should be explored.[20] This threshold was used in Washington state's proposed financial viability test presented above (see table 5-5). It is a test that can be applied to emerging or existing water systems, not necessarily as the sole determinant of a water system's fate but as a tool for use along with other assessment methods.

Table 5-10 presents a framework for evaluating a community's demographic character in terms of those factors that might affect customers' ability to pay for water service. These indicators cover population characteristics, income characteristics, employment, government finances, utility service, and other quality-of-life issues. Many of these relate to the issue of growth, discussed above in relation to utility risk. This type of analysis may be especially important in weighing the potential advantages of structural alternatives. Where a community simply cannot support the cost of water service by an independent small system, the future viability of such a system is doubtful and structural alternatives should be sought.

Management Performance

Chapter 1 posed the following questions in relation to managerial performance of water systems: Does the system benefit from management expertise? Is management competent to comply with environmental, public health, and economic regulations? Does the system have a business plan to assure viability? Does management avail itself of outside resources and assistance? Is management responsive to customer needs?

Lack of growth (especially when expected growth does not materialize) shifts the burden of success onto the shoulders of management. Yet as noted in chapter 2, lack of business knowledge or experience also is a key issue in business failure. The importance of management competence is growing along with the technical and financial demands on water systems. Thus a management assessment would be appropriate in certifying emerging systems and evaluating existing ones. Currently, however, management capability is not a major focus of the investigation performed by many states on new applicants for water certificates. One reason for this is

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20 "Financial Manual for Small Water Utilities," (A joint project of the Washington State Department of Health and the U.S. Environmental Protection Agency, unpublished draft dated October 1991).

TABLE 5-10
INDICATORS FOR USE IN A DEMOGRAPHIC ANALYSIS OF A UTILITY SERVICE AREA

Population Characteristics

- Population of the service territory
- Trends in population
- Household size

Income Characteristics

- Median family income
- Percent below the poverty line
- Public assistance data

Employment

- Employment and unemployment rates
- Trends in employment and unemployment
- Listing and assessment of major employers
- Evaluation of potential future employment losses and opportunities

Government Finances

- Property tax revenues
- Other local revenue sources
- Condition of local government finances (including debt)

Utility Service

- Stability of the customer base
- Shutoffs and disconnections
- Uncollectible accounts
- Payment assistance programs
- Comparison with other utilities (electric, gas, telephone)

Quality of Life

- Crime and law enforcement statistics
- Housing availability and conditions
- Property values and trends in property values
- Education and employment training opportunities
- Availability and quality of medical care

Source: Author's construct.

that management assessment tends to be somewhat more qualitative in nature, particularly when compared with financial assessment.

Still, it is possible to develop performance indicators for evaluating water utility management. The U.S. Environmental Protection Agency provides numerous resources for assessing managerial capability, although their orientation leans somewhat toward publicly owned utilities.[21] Table 5-11 presents some simple checklists (financial reporting, purchasing, and user service charges) that can be used in evaluating the management of an existing system. The utility manager can use such a checklist in self-evaluation. Regulators can use a similar approach in a simplified management audit or other proceeding.

When additional resources are available, a more complex management analysis can be used. Table 5-12 provides a management performance assessment matrix derived from NRRI research on management auditing.[22] Utility performance in the areas of planning, organizing, and controlling are evaluated across seven functional areas. The research report on which the matrix is based presents detailed diagnostic guidelines for performing a comprehensive assessment of management practices and performance. In a simplified approach, suitable for smaller utilities, symbols (+/-) or grades (A,B,C) could be assigned for each cell of the matrix to indicate problem areas. This type of model could be adapted to the interests and needs of any particular regulatory jurisdiction or utilities of different size.

A larger utility, with its higher level of resources and more complex management structure, may require a more detailed audit. The investment in a detailed audit for larger utilities is likely to pay off in terms of identifying areas of potential improvement that will yield savings for both utilities and ratepayers. In this type of analysis, detailed questions can be used for each cell of the matrix to develop an in-depth understanding of each management issue. For example, in assessing *resource capability* in the area of *customer service and information*, training and development of customer service and meter reading personnel are

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[21] U.S. Environmental Protection Agency, *Financial Capability Guidebook* (Washington, DC: U.S. Environmental Protection Agency, 1984).

[22] Vivian Witkind Davis, Raymond W. Lawton, Raymond J. Krasniewski, Robert W. Backoff, and Margaret C. Allen, *A Qualitative Indicator System for Assessing Utility Management Practices and Performance* (Columbus, OH: The National Regulatory Research Institute, 1986).

TABLE 5-11

SIMPLE CHECKLISTS FOR ASSESSING UTILITY MANAGEMENT PERFORMANCE

Financial Reporting Checklist

[ ] Water and wastewater operations are accounted separately.

[ ] The utility uses accrual accounting methods.

[ ] The utility receives monthly reports of revenue and expenses.

[ ] Reports show both budget and actual figures.

[ ] Reports arrive by the 10th day of the following month.

[ ] The utility keeps its financial reports for at least four years.

Purchasing Checklist

[ ] Purchasing is centralized.

[ ] Major purchases are based on specifications that define requirements.

[ ] Standard quote/bid forms are used.

[ ] No purchases are made without a purchase order.

[ ] Exceptions are specified for emergency purchases.

[ ] Goods are inspected immediately for quality and damage.

[ ] Stock quantities are specified for all inventory items.

User Service Charges Checklist

[ ] All costs are identified.

[ ] Costs are allocated proportion.

[ ] Flow characteristics are known for each customer class.

[ ] Each customer's use is known or fairly estimated.

[ ] Customers are billed proportionally to use.

[ ] Billing cycle provides timely revenues.

[ ] Established procedures assure collection of delinquent bills.

Source: Adapted from Paul L. Shinn, Steven Turtil, Benjamin Mays, and Haig Farmer, *A Water and Wastewater Manager's Guide for Staying Financially Healthy* (Washington, DC: U.S. Environmental Protection Agency, 1989), (brochure).

TABLE 5-12

UTILITY MANAGEMENT PERFORMANCE ASSESSMENT MATRIX

	Functional Areas						
	Utility executive management process	Construction project management and control	Internal auditing	Rate program analytical process	Customer service and information	Management information systems	Work force productivity
ASSESSMENT CRITERIA							
Planning							
Policy and philosophy	____	____	____	____	____	____	____
Planning & forecasts	____	____	____	____	____	____	____
Scope of function	____	____	____	____	____	____	____
Priorities	____	____	____	____	____	____	____
Roles & responsibilities	____	____	____	____	____	____	____
Organizing							
Resource capabilities	____	____	____	____	____	____	____
Resource allocation	____	____	____	____	____	____	____
Program plan	____	____	____	____	____	____	____
Implementation	____	____	____	____	____	____	____
Controlling							
Program & project control	____	____	____	____	____	____	____
Reports & progress reviews	____	____	____	____	____	____	____
Output evaluation	____	____	____	____	____	____	____
Impact evaluation	____	____	____	____	____	____	____

Source: Adapted from Vivian Witkind Davis, Raymond W. Lawton, Raymond J. Krasniewski, Robert W. Backoff, and Margaret C. Allen, A Qualitative Indicator System for Assessing Utility Management Practices and Performance (Columbus, OH: The National Regulatory Research Institute, 1986). The source provides detailed diagnostic guidelines for performing a comprehensive assessment of management practices and performance. For a cursory assessment, symbols or grades could be used to indicate general problem areas.

positive performance indicators, while inadequate training and excessive reliance on estimation (rather than actual meter reading) are negative indicators.

In comparison, given their less complex structure, it makes little sense to invest an excessive amount of resources in a detailed management audit for small utilities. However, small utilities also have much room for improvement, so even a rudimentary analysis can yield high returns. The matrix can be adapted for use in a low-cost assessment of management practices and performance by utilities themselves or regulatory agency staff. Once actual or potential problem areas for the small utility are identified, possible solutions can be devised with an assignment of priority to those yielding the highest return. Some solutions might address more than one problem simultaneously, as management audits often reveal.

Management capability for both emerging and existing water systems also can be evaluated on the basis of planning capability, an idea advanced by Wade Miller Associates, Inc. in their study for Pennsylvania:

> [One] attribute of the business plan requirement is that the exercise itself is a good test of the caliber of management and of the ability to run a successful operation. No doubt there are many existing small systems that will need assistance in going through the steps of the business plan process the first time. The process teaches very fundamental management principles, however, and can therefore make a tangible contribution to enhanced viability in the course of plan development.[23]

The business plan proposed in the Wade Miller analysis consists of four subcomponents, for which detailed outlines are presented in appendix F of this report:[24]

- A facilities plan describing proposed new facilities and the condition of existing facilities; needs for rehabilitation and replacement; and future needs to meet requirements of the SDWA.

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23 Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), 6-2.

24 Ibid., ii. The adaptation used here recognizes four rather than three planning components, without having a substantive effect on the recommendations. In the original study, the "management and administrative plan" and the "operations and maintenance plan" are subsumed under a "management plan."

- A **management and administration plan** describing arrangements to assure performance of functions necessary to properly administer the enterprise, including documentation of the credentials of management personnel.

- An **operations and maintenance plan** describing provisions for performance of all routine O&M tasks necessary to assure proper functioning of the system.

- A **financial plan** describing provisions to assure: adequate revenues to meet cash flow requirements computed on the basis of the *full costs* of providing the service; adequate initial capitalization; and access to additional capital to meet contingency needs.

A planning approach to viability is especially consistent with the comprehensive viability policies discussed in chapters 3 and 4. Planning not only improves management performance, but it has relevance for designing and implementing institutional policies for improving the viability of the water supply industry over the long term.[25]

Institutional Assessment

While the focus here is mainly on methods of assessing water utility performance, it is worth noting that the institutional dimensions can and should be subjected to periodic assessment as well. The questions posed in chapter 1 can be used to develop a framework for assessing the adequacy of institutional arrangements:

- Regulatory. Is the certification process for emerging water systems adequate for assuring viability? Is regulatory oversight of existing water systems adequate for assuring their viability? Are regulators implementing appropriate tools for improving the viability of the water industry?

- Structural. Is the water supply industry structured to exploit economies of scale and operate efficiently? Are there barriers to industry restructuring? Are there barriers to coordination and sharing of facilities?

[25] See also, Janice A. Beecher, James R. Landers, and Patrick C. Mann, *Integrated Resource Planning for Water Utilities* (Columbus, OH: The National Regulatory Research Institute, 1991).

- **Comprehensive.** Are governmental roles in water resource management coordinated? Is integrated resource planning a guiding paradigm? Does the regulatory system promote structural solutions, such as consolidation and other means of achieving economies of scale and optimal performance?

Any jurisdiction interested in the viability of water systems can and probably should assess these institutional issues on an ongoing basis. In many ways, these evaluations are as essential as evaluations of utility performance. On the basis of this study, it can be concluded that many states have made considerable headway in designing appropriate policies to address small system viability. While it would be vastly premature to suggest that methods are available for resolving all of the problems of small systems, the recent institutional achievements in this area are notable. More success seems likely.

CHAPTER 6

FINANCIAL DISTRESS MODELS

Effective viability policies require assessment methods that can be used by regulators and others for screening utilities and triggering intervention as needed. Because financial performance is so vital to water system viability, a need exists for methods specifically designed to assess the financial health of existing water systems and the expected health of emerging water systems. Some basic assessment methods were introduced in the previous chapter, but more complex modeling approaches can be used as well.

Modeling financial failure has emerged almost as a contemporary art form, becoming more important with the recent failure or near failure of numerous banks, savings and loans, and nonregulated companies. The reason for the surge in interest is obvious. Investors, lenders, depositors, legislators, potential merger partners, and so on all are concerned about the potential failure of an institution. Tumultuous economic times, the record number of bankruptcies, and the financial catastrophe in banking are ample reasons to study the causes and prevention of business failure.

Some of the business failure models and the techniques used in them can be used by regulators for diagnosing and monitoring the financial distress of water utilities. Identifying distressed water utilities as early as possible is important since their distress can affect investors, creditors, ratepayers, local government agencies, and regulatory commissions in serious ways. In additional to financial risk, the potential health risk of weak and failing water companies is another reason for regulators to get involved in identifying and taking regulatory action toward distressed systems.

This chapter reviews the bankruptcy and failure prediction models that have appeared in the finance literature and develops a distress classification model for water utilities. The methodology can be used as an early warning system to identify potentially bankrupt or financially distressed water utilities, as a screening device applied to systems seeking certification, and as a viability test for evaluating prospective structural changes among existing systems. All of these outcomes singly or together should help reduce the future impact of distressed water utilities.

Business Failure Research

Interest in finding financial models that will predict business failure is widespread among financial institutions such as investment banks, commercial banks, pension funds, insurance companies and other lenders, investors, federal banking agencies, and so on. The rapid development of "leveraged buyouts" (LBOs) in the late 1980s created even greater concern about predicting failure for the issuers of the "junk bonds" used in most leveraged buyouts.[1]

Two types of bankruptcy models have been reported in the literature beginning with the Beaver model in 1966.[2] The major focus of most published research has been on publicly owned firms whose stock is widely traded such as manufacturing, retailing, construction and similar companies. A secondary but smaller focus has been on models to detect financial distress in the banking and savings and loan industries. The bank related models are generically referred to as "early warning" models. While much of the early research was aimed at preventing bank failures, interest in bank related models diminished in the late 1970s as models immediately applicable to large nonregulated firms that were failing were developed.[3]

Part of the shift in interest was due to the realization by some researchers that the federal banking agencies were not likely to adopt their approach because the models lacked a high degree of accuracy in predicting failure more than one year preceding the failure.[4] One type of prediction error in the models (a type I error) would risk predicting the failure of a healthy bank. The potential

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[1] Edward I. Altman, *Distressed Securities: Analyzing and Evaluating Market Potential and Investment Risk* (Chicago, IL: Probus Publishing, 1991). The analysis presented in this chapter is an extension of Altman's research on bankruptcy, failure, and default.

[2] William Beaver, "Financial Ratios as Predictors of Failure," *Journal of Accounting Research (Supplement)* 4 (1966): 71-102.

[3] Edward Altman, "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy," *Journal of Finance* 23 (September 1968): 589-609; Joseph F. Sinkey Jr. and D. A. Walker, "Problem Banks: Identification and Characteristics," *Journal of Bank Research* 5 (Winter 1975): 208-217; Joseph F. Sinkey Jr. and D. A. Walker, "Identifying Problem Banks and How Do the Banking Authorities Measure a Bank's Risk Exposure?" *Journal of Money, Credit and Banking* 10 (May 1978): 184-193.

[4] Harlan D. Platt and Marjorie Platt, "Development of a Class of Stable Predictive Variables: The Case of Bankruptcy Prediction," *Journal of Business, Finance and Accounting* 17 (Spring 1990): 31-51.

consequence of such errors was a possible run on the bank (a self-fulfilling failure), something that federal bank regulators want to avoid.

Those engaged in business failure research in the nonregulated sectors seldom refer to the research coming from the banking literature. Likewise, banking studies seldom review or refer to the research in the nonbanking sectors. This is surprising since, as noted earlier, much of the early research in bankruptcy prediction focused on the banking sector.[5] Research begun in the FDIC eventually shifted to the private nonbanking sectors as researchers left the federal bank regulatory agencies.[6]

In developing a model or models that could be made applicable to regulated industries, the banking industry models seem useful. After all, early detection of financial weakness is an on-going part of the federal bank regulatory framework, even though prediction per se is not done by federal banking agencies. Moreover, most early warning bank models are not empirically derived as are the nonbanking models; that is, they are not statistically estimated from a sample of bankrupt firms since banks seldom file for bankruptcy protection.

Early warning banking models may have applicability to water utility regulation for other reasons as well. Banks are chartered by the Comptroller of the Currency (called national banks) and by individual states (called state banks). All banks must apply to the Federal Deposit Insurance Corporation (FDIC) for deposit insurance. The FDIC insurance approval investigation is extremely rigorous since all failed banks must be merged, restructured, or managed by the FDIC (as of 1990 by the newly established Resolution Trust Corporation within the FDIC which was created by Congress in 1989). Thus the interest of the government in assuring the viability of new banks is not unlike its interest in assuring the viability of new water systems. Like the FDIC, government agencies may have ultimate responsibility for managing a failed system (as in Texas), operating it completely (as in Nevada), or forcing its takeover by another entity (as in Connecticut).

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5 Altman, "Financial Ratios, Discriminate Analysis and the Prediction of Corporate Bankruptcy," 589-609; Sinkey, "Problem Banks: Identification and Characteristics," 208-217.

6 For example, Joseph Sinkey and Robert Eisenbeis.

Surveillance Models Used in Banking

A brief description of the surveillance system used by all banking agencies to monitor banks helps explain the rating system used by all federal and state banking agencies. Improving the rating system is an ongoing enterprise by federal bank regulators. The monitoring system used by banking agencies identifies key ratios, including peer comparison ratios, that are used in bank reviews and examinations. Bank reviews are done quarterly (off-site reviews) or annually (on-site examinations). Subsequent to the various examinations and reviews the ratios are condensed into a rating system known as CAMEL between 1 (excellent condition) to 5 (approaching failure). CAMEL is an acronym for capital adequacy (C), asset management and turnover (A), management (M), efficiency (E), and liquidity (L).

The FDIC and other agencies use the standard quarterly uniform bank performance reports (UBPR) filed by all federally insured banks to assign a quarterly CAEL rating (CAMEL without the M). The CAEL is derived from 250 financial ratios which are calculated from the quarterly reports. The 250 ratios are reduced to nineteen "key" ratios to determine the final CAEL rating. Three years of data are incorporated into the ratios. The ratios for an individual bank are compared with "benchmark" or "base-line" ratios eventually to set a rating for that bank. The benchmark ratios are confidential and even these are updated regularly to reflect current economic and financial conditions affecting individual banks and their regions. CAMEL ratings are assigned by bank examiners after an on-site examination using established guidelines and compared with CAEL ratings. Large banks typically are examined every twelve months and small banks every eighteen.

The FDIC also uses an "early-early" warning system based on three key warning ratios. One of these three is the "internal equity growth rate" which is similar to the retained earnings rate of change which is the best predictor ratio in several failure models.[7] The CAEL rating system is considered quantitative and objective and this is regularly compared with the more subjective and qualitative CAMEL rating to see where and why differences exist. The major difference between CAMEL and CAEL is the "M" for management which is only assigned by the examiner after evaluating the bank on site. It is by nature very subjective.

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[7] Altman, Haldeman, and Narayanan, "ZETA Analysis: A New Model to Identify Bankruptcy Risk of Corporations, 29-54; Demirguc-Kunt, "Deposit-Institution Failures: A Review of Empirical Literature," 2-18.

Quarterly changes in the CAEL rating are rigorously reviewed by the FDIC and subsequent nonscheduled on-site examinations may be required by the FDIC to explain divergences from quarter to quarter of CAEL or between CAEL and CAMEL.

Thus CAEL also serves as a supervisory tool in reviewing the CAMEL rating of examiners. It is described by FDIC officials as a "ratings prediction model" not a "failure prediction model." Failure prediction continues to occupy some researchers at the federal agencies but their models are mainly theoretical and there is no consensus when it comes to independent variables, statistical techniques, and other issues.[8] To date no agency has adopted any specific model from the finance literature for use in failure prediction although failure prediction and early warning surveillance models have the same goal: to flag weak and distressed banks far in advance of insolvency or liquidation.

One of the truly significant findings in bank failure research is that management factors, namely poor management, is usually the primary cause of bank failure and closure.[9] The Comptroller of the Currency concluded in its study *Bank Failure* that poor management was the single most important cause of failure.[10] These findings should impress utility regulators enough to look seriously at the quality and experience of managers in certifying new water companies.

Basic Feature of Business Failure Models

In recent review articles several authors discuss the major accomplishments and defects of the business failure research and suggest research needs in the field.[11] In his 1987 review article, Frederick Jones identifies fifty-two major

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8 Demirguc-Kunt, "Deposit-Institution Failures."

9 Pantalone and Platt, "Predicting Commercial Bank Failure Since Deregulation," 37-46.

10 Office of the Comptroller of the Currency, *Bank Failure*, Washington, DC, (June 1988).

11 Frederick L. Jones, "Current Techniques in Bankruptcy Prediction, *Journal of Accounting Literature* 6 (1987): 131-164; Coleen Pantalone and Marjorie Platt, "Predicting Commercial Bank Failure Since Deregulation," *New England Economic Review* 4 (July/August 1987): 37-46; Platt and Platt, "Development of a Class of Stable Predictive Variables: The Case of Bankruptcy Prediction, 31-51; Asli Demirguc-Kunt, "Deposit-Institution Failures: A Review of Empirical Literature," *Economic Review*, Federal Reserve Bank of Cleveland (Quarter 4, 1989): 2-18.

articles on bankruptcy prediction since 1966 and there have been many since.[12] Some of the basic features of the predominant models are reviewed here.

Most of the business failure models are empirically derived; that is, there is no theoretical basis for choosing a variable other than the fact that it has been used previously and found to be statistically significant. In fact, there is no widely accepted theory of bankruptcy that determines when or why a firm does or should enter into a Chapter 11 reorganization as opposed to Chapter 7 liquidation, or a merger, or some other option. Nothing about the process seems very predictable and in the banking industry there is accumulating evidence that the agenda and desires of the regulators, political pressures, and other factors may be significant in explaining bankruptcy or closure of banks.[13] Interestingly, these observations may be important for jurisdictional water systems. Water systems, too, can be affected by both regulatory and political pressures.

Much of the business failure research outside of banking is focused on relatively large firms since data are not readily available for models based on small firm failure. This is unfortunate since the bankruptcy rate among small firms (including banks) is somewhat greater than among large firms even though the economic impact is probably less severe in the case of a small-firm failure.

In banking, the majority of failures historically have been of small banks. With the rash of recent bankruptcies among large banks this may change. But the large data base needed to empirically estimate a model and replicate it with an out-of-sample group of failed banks makes research difficult in both nonbank and bank modeling. The recent trend of large bank failures partially explains the renewed interest in failure prediction by the Federal Reserve System.[14]

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12 Jones, "Current Techniques."

13 Demirguc-Kunt, "Deposit-Institution Failures: A Review of Empirical Literature," 2-18.

14 The renewed interest is indicated by the publication of two forthcoming articles on the subject by the Cleveland Federal Reserve Bank (Dr. William Gavin, by phone, March 1991).

Statistical Methods

Early business failure models started with univariate (one-variable) models and progressed to multivariate models.[15] Interestingly, one researcher was able to predict bankruptcy with an 87 percent accuracy with just one ratio, cash flow to total debt.[16] More recent models have used discriminant analysis, probit and logit models, and recursive partitioning models.[17]

Probit and logit models (one of which is applied later in this chapter) avoid some statistical problems of discriminant analysis but the results with classification accuracy seems to be equally as good with any statistical technique.[18] Probit and logit models use cumulative probability functions so as each variable enters the model the cumulative probability of bankruptcy or nonbankruptcy rises, albeit nonproportionally. Finally, many mathematical transformations are used to make models more realistic and statistically legitimate. For example, one research team uses a log transformation on one of the variables--asset size--to normalize its effects on the probability prediction, since there were large differences in the sizes of sample firms.[19] As noted later one of the difficulties of adopting an existing model to water systems is the model's complexity. Manipulating mathematically complicated models requires time, patience, and expertise; in some cases the data base necessary to use them is not readily available.

Many independent variables (or predictors) have been tested for their accuracy in predicting future bankruptcies. Approximately 100 different variables have been

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15 On univariate modeling, see Beaver, "Financial Ratios as Predictors of Failure," 71-102; on multivariate modeling, see Edward Altman, *Corporate Financial Distress* (New York: John Wiley & Sons, 1983).

16 Jones, "Current Techniques in Bankruptcy Prediction," 131-164.

17 Halina Frydman, E. Altman and Duen-Li Kao, "Introducing Recursive Partitioning for Financial Classification: The Case of Financial Distress," *Journal of Finance* 11 (March 1985): 269-291.

18 Jones, "Current Techniques in Bankruptcy Prediction," 131-164.

19 Edward Altman, Robert Haldeman and P. Narayanan, "ZETA Analysis: A New Model to Identify Bankruptcy Risk of Corporations," *Journal of Banking and Finance* 1 (June 1977): 29-54.

tested in bankruptcy studies.[20] The FDIC has used upwards of 250 variables in searching for its ongoing surveillance model (discussed below). The abundance of potential explanatory variables in this area of research calls for statistical methods that narrow the field to the most important predictors. To develop parsimonious models (fewer variables) as well as avoid the problem of multicollinearity (intercorrelation among the independent variables) a stepwise program is frequently used with discriminant analysis or logit models. Factor analysis is also used to reduce the number of variables to "factors" which are common sets of variables with similar characteristics.

Significant Variables

The types of financial ratios that appear to be common to most failure prediction studies are leverage ratios, liquidity ratios, income ratios, and historical earnings ratios. Considerable evidence suggests that as long as each type is represented (for example, liquidity or leverage ratios) specific variables make little difference in the predictive accuracy of the models.[21]

There also is much research centering on cash flow as a key predictor variable, but conflicting notions exist over the best definition of cash flow especially with reference to the accruals versus nonaccrual items used to define cash flow (for example, taxes payable are deducted in accrual models). Cash flow is one of the key ratios in the classification model developed below because it is one of the most consistently significant variables in prediction models. In summary, what appears to be a primary outcome of this research is the substitutability of ratios within the four basic groups. This finding influences the choice of key ratios reported later in this chapter.

As noted earlier, Chen and Shimerda identify 100 variables that have been used in failure prediction research and thirty-one of these have been significant in a

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20 K. Chen and T. Shimerda, "An Empirical Analysis of Useful Financial Ratios," *Financial Management* 10 (Spring 1981): 51-60.

21 M. Hamer, "Failure Prediction: Sensitivity of Classification Accuracy to Alternative Statistical Methods and Variable Sets," *Journal of Accounting and Public Policy* 2 (1983): 289-307.

statistical sense.[22] Pinches reduced many variables to seven factors similar to the factors of Chen and Shimerda and those used by other researchers.[23] The Pinches factors were used by Platt and Platt, and it is this model that is applied to water utilities in this study.[24] The Pinches factors are: return on investment, capital turnover, leverage, liquidity, cash position, inventory turnover, and receivables turnover. These factors were used by Zavgren in a series of combinations that led her to find three key sets of ratios to be successful predictors of corporate bankruptcy: financial leverage, asset turnover, and liquidity (the best short-term predictor of failure).[25] In an important study, Hamer used four variable "sets" that she derived from several major studies including that by Altman.[26] Each set of variables measured profitability, liquidity, and leverage. For each of the five years studied she found no significant differences in classification results using any set.

Many if not most of the prediction models found in the literature have used quite similar key financial ratios in their construction. In banking studies similar variables also appear consistently as predictors of failure, although some banking related variables are industry specific and have no counterpart in nonbank firms. An example is the loan/deposit ratio, which is commonly used in banking studies. While banking related ratios are somewhat unique the words of Demirguc-Kunt are a useful summary: "all authors find capital adequacy (C), generally proxied by the book value of net worth, to be significant.... In addition, earnings (E), usually a

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[22] Chen and Shimerda, "An Empirical Analysis of Useful Financial Ratios," 51-60.

[23] G. Pinches, K. Mingo and J. Caruthers, "The Stability of Financial Patterns in Industrial Organizations," *Journal of Finance* 28 (May 1973): 389-396; Chen and Shimerda, "An Empirical Analysis of Useful Financial Ratios," 51-60.

[24] Platt and Platt, "Development of a Class of Stable Predictive Variables: The Case of Bankruptcy Prediction," 31-51.

[25] C. Zavgren, "The Prediction of Corporate Failure: The State of the Art," *Journal of Accounting Literature* 2 (1983): 1-37.

[26] Hamer, "Failure Prediction: Sensitivity of Classification Accuracy to Alternative Statistical Methods and Variable Sets," 269-291; Altman, "Financial Ratios, Discriminate Analysis and the Prediction of Corporate Bankruptcy," 589-609.

measure of net income, are a significant indicator of financial condition."[27] Capital adequacy, though not specifically used in the models below, is reflected in the cumulative profitability variables and essentially affects retained earnings, one of the variables found in many nonbank models.

Application of the Available Models to Water Utilities

The finance literature clearly emphasizes the idea that a few key financial ratios can be used to predict bankruptcy and distress. The comparability of key variables is illustrated in table 6-1. To further illustrate this reality the Altman 1968 model, the most widely discussed model in financial textbooks, and the Platt and Platt model are applied below using water utility data. Water companies are unique in many ways and therefore no published model fits them perfectly. But the key ratios developed from the literature help identify several that can legitimately be used to detect weak water systems.

Because water systems have similarities both to banking and nonbanking firms the bankruptcy and early warning models can be used to identify variables and ratios applicable to the water sector. None of these models is perfectly adaptable to water systems. Most make use of financial variables and techniques suggestive of what utility regulators could do relatively easily and inexpensively to develop water-industry-specific prediction models. A set of key financial ratios has been successfully used in this line of research and they can be used simply and quickly to detect weaknesses in water systems.

Two failure models that are commercially available, the Altman model and the Platt and Platt model, are applied to water utility data in appendix G. The 1968 Altman model, referred to as the *Z-Score Model*, was updated and slightly changed in 1977. It is referred to as the *Zeta* model and sold by Dr. Altman's firm. The 1968 and 1977 models are similar and the prediction accuracy equally good.[28] The coefficients for the 1977 model only are available to client users so the 1968 version is used. The fact that the Platts obtained a copyright for their model also indicates the increasingly important commercial market for these models.

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[27] Demirguc-Kunt, "Deposit-Institution Failures": A Review of Empirical Literature," 14.

[28] Altman, *Corporate Financial Distress*.

TABLE 6-1

COMPARISON OF KEY FINANCIAL RATIOS USED IN FINANCIAL DISTRESS MODELS

Variable	Altman Model	Platt and Platt Model
Profitability	Operating income / Total assets	Cash flow / Sales
Leverage	Market value equity / Book value debt	Total debt / Total assets
Liquidity	Current assets / Current liabilities	Net fixed assets / Total assets
Profit trend	Retained earnings / Total assets	Sales growth / Industry growth

Source: Edward Altman, "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy," *Journal of Finance* 23 (September 1968): 589-609; Edward Altman, Robert Haldeman and P. Narayanan, "ZETA Analysis: A New Model to Identify Bankruptcy Risk of Corporations," *Journal of Banking and Finance* 1 (June 1977): 29-54; and Harlan D. Platt and Marjorie Platt, "Development of a Class of Stable Predictive Variables: The Case of Bankruptcy Prediction," *Journal of Business, Finance and Accounting* 17 (Spring 1990): 31-51.

As mentioned, water companies are different from the types of firms that were used to derive these models. In fact, both models were empirically estimated from a sample of bankrupt firms called the in-sample group, and then replicated with another group of failed firms called the out-of-sample group. When applied to an out-of-sample group the models classified them as bankrupt or nonbankrupt very accurately. These are among only a few prediction models that have been replicated, which improves confidence in the reliability of models according to most researchers.[29] Unfortunately, none of the in-sample or out-of-sample companies were utility companies.

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29 Platt and Platt, "Development of a Class of Stable Predictive Variables: The Case of Bankruptcy Prediction," 31-51.

The models performed poorly in terms of measuring financial distress of water utilities, as expected. The reason for the poor showing for both the Altman and Platt and Platt models is simply that utilities are too different for these models to be applied in their current form. However, an important aspect of the Platt and Platt model is the role that industry-specific factors play on firms and their potential for bankruptcy. Industry sales growth and industry output significantly affect firm bankruptcy in this model. Sales growth can be a key determinant of the viability of newly certified water utilities. However, for many distressed systems overall water sales and water sales per capita are not growing so industry-relative factors can severely affect water company profits, especially newly certified water company profits. The ratios used in the model developed below are industry-relative for that reason.

The application of the Altman and Platt and Platt models confirms again that a few key ratios similar to the sets used by other researchers can easily be used in the analysis of financial distress. The development of a model specifically designed to measure distress for water utilities clearly is justified.

NRRI Distress Classification Model for Water Utilities

Although commercially available failure prediction models are not readily applicable to regulated water utilities, they do shed light on the key ratios that are consistently good failure predictors in a variety of models. A first step in identifying weak water companies as early as possible is to calculate several key financial ratios, such as those used in commercially available prediction models.

The method proposed here follows previous NRRI research on this issue.[30] Table 6-2 presents the key financial ratios chosen for the analysis. The ratios measure profitability (X1 and X7), liquidity (X2), leverage (X3, X8, and X10), profitability trend (X4), growth (X5), and efficiency (X6). The first seven are expected to vary inversely (negatively) with financial distress, while the last three are expected to vary positively. These ten ratios, standard in that they commonly are part of the variable sets referred to throughout the previous discussion, were calculated for two groups of companies: the fifteen strongest and the fifteen

30 Patrick C. Mann, G. Richard Dreese, and Miriam A. Tucker, *Commission Regulation of Small Water Utilities: Mergers and Acquisitions* (Columbus, OH: The National Regulatory Research Institute, 1986).

TABLE 6-2
KEY FINANCIAL RATIOS USED IN ASSESSING FINANCIAL DISTRESS

Ratio	Measure	Definition	Relation to Failure
X1	Profitability	Cash flow/sales	-
X2	Liquidity	Current assets/current liabilities	-
X3	Leverage	Book common equity/total assets	-
X4	Profitability trend	Retained earnings/common equity	-
X5	Growth and efficiency	Sales/total assets	-
X6	Efficiency and profit	Operating revenues/operating expenses	-
X7	Profitability	Net income/sales	-
X8	Leverage	Total debt/total assets	+
X9	Liquidity	Net fixed assets/total assets	+
X10	Leverage	Current liabilities/total debt	+

Comparison with Other Models		Platt & Platt	Altman
X1	Profitability	X2	X2 & X3
X2	Liquidity	X3	X1
X3	Leverage	X4	X4
X4	Profitability trend	X2	X2
X5	Growth and efficiency	X1	X5
X6	Efficiency and profit	X2	X2 & X3
X7	Profitability	X2	X2 & X3
X8	Leverage	X4	X4
X9	Liquidity	X3	X1
X10	Leverage	X5	X4

Comparison of NAWC Firms		Viable Firms	Distressed Firms	Viable/ Distressed
X1	Profitability	0.258	0.095	2.71
X2	Liquidity	1.702	1.157	1.47
X3	Leverage	0.294	0.226	1.30
X4	Profitability trend	0.500	0.318	1.57
X5	Growth and efficiency	0.275	0.236	1.17
X6	Efficiency and profit	1.321	1.121	1.18
X7	Profitability	0.175	-0.029	-6.03
X8	Leverage	0.699	0.754	0.93
X9	Liquidity	0.823	0.734	1.12
X10	Leverage	0.100	0.181	0.55

Source: Authors' construct.

weakest water utilities from the 1989 NAWC *Operating and Financial Data* based on their return on equity (ROE). For the strong firms, ROE averaged 15.4 percent and for the weak firms, it averaged -3.7 percent.[31] It is clear that the ratios in table 6-2 are quite different between the two groups of water companies. Ratios X7 and X1, both of which measure profitability, show the greatest relative difference in the table.

As also seen in table 6-2, the ten ratios are similar to those used by Altman and by Platt and Platt. The ratios may be slightly different in construction but they essentially measure the same thing financially. For example, ratio X7 (net income/sales) is a simpler ratio that can be substituted for ratio X1 (cash flow/sales). Cash flow/sales is the most common ratio found in prediction models and is a standards and broad measure of financial health for cash generating companies. Net income/sales is an absolute and narrow measure of distress and can always be used as a preliminary distress test. Cash flow (measured by net income plus depreciation, which are the two primary sources of funds in a cash flow statement) assigns an important role to depreciation. Depreciation must be added to determine cash flow since it is deducted originally to calculate net income. Finally, a firm can be considered bankrupt when total liabilities exceed assets and the firm's equity cushion is negative. For water systems, these unfortunate conditions are too often present.

Developing the Classification Scheme

As noted, the first seven of the financial ratios presented are inversely related to financial distress, that is, the higher the ratio the lower the probability of distress. For simplicity, and because of the redundance in the variables, values of the seven inversely related ratios can be added together to comprise a distress score. This is illustrated in table 6-3 for a viable and a distressed water system.

Interpreting these findings requires a classification model using data for comparable firms. Again using the NAWC data, the sum of the seven ratios for the fifteen strong firms was 4.50 (with a standard deviation of .99); for the fifteen weak firms, the sum was 3.10. A statistical probability function as illustrated by

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31 Many of the strong firms were also strong in 1985 and many of the weak firms were weak in 1985. In fact, for the strong firms, ratios were nearly identical for the years compared (1985, 1989, and 1990).

TABLE 6-3
DISTRESS CLASSIFICATION MODEL WITH ILLUSTRATIVE DATA

	Viable System*		Distressed System*	
Ratio X1: Profitability				
$\frac{\text{Net income + depreciation}}{\text{Annual operating revenues}}$	$\frac{\$3.3 + 1.3}{22.9}$	= .200	$\frac{\$.240 + 1.6}{14.3}$	= .129
Ratio X2: Liquidity				
$\frac{\text{Current assets}}{\text{Current liabilities}}$	$\frac{5.8}{3.7}$	= 1.570	$\frac{3.1}{5.1}$	= .607
Ratio X3: Leverage				
$\frac{\text{Common stock equity}}{\text{Total assets}}$	$\frac{16.9}{51.8}$	= .326	$\frac{11.1}{65.3}$	= .170
Ratio X4: Profit Trend				
$\frac{\text{Retained earnings}}{\text{Common stock equity}}$	$\frac{11.1}{16.9}$	= .657	$\frac{5.0}{11.1}$	= .450
Ratio X5: Growth and Efficiency				
$\frac{\text{Annual operating revenues}}{\text{Total assets}}$	$\frac{22.9}{51.8}$	= .442	$\frac{14.3}{65.3}$	= .219
Ratio X6: Efficiency and Profitability				
$\frac{\text{Annual operating revenues}}{\text{Annual operating expenses}}$	$\frac{22.9}{18.7}$	= 1.220	$\frac{14.3}{12.0}$	= 1.190
Ratio X7: Profitability				
$\frac{\text{Net income}}{\text{Annual operating revenues}}$	$\frac{3.3}{22.9}$	= .144	$\frac{.240}{14.3}$	= .017
Distress Score (sum of the ratios)		= 4.56		= 2.78

* Dollar values are in millions.

the normal curve in figure 6-1, shows that 82 percent of all NAWC water companies would have values between 3.0 and 6.0 in 1989, using 1.5 standard deviations in each direction. Water companies with values below 3.0 could be considered "distressed" those at 4.5 and above "viable." Using similar logic, those firms with values between 3.0 and 4.5 can be considered "weak" or "marginal."[32]

This technique provides a simple and practical means of classifying water systems. Although not necessarily complete and somewhat limited from a statistical viewpoint, it can provide regulators with a basic tool that may be preferred to no method at all or some purely subjective approach. Moreover, ratio analysis is the most common, simple, and widely used of all financial analysis techniques. The use of the classification model is strengthened by the fact that the total of the seven ratios for the weak firms is 3.1, a figure close to the 3.0 that results under the normal curve discussed above.

Thus, a generalized evaluation system can be developed using these results, whereby water systems can be classified as follows:

If the distress score is:	The system can be classified as:
4.0 or more	Good to excellent
3.0 to 3.99	Weak to marginal
3.0 or less	Distressed

Water companies with an overall distress score of 3.0 or below are likely to be in need of immediate attention. Companies with a distress score totaling more

32 Since the statistical technique is based on the fifteen "best" NAWC water companies, the classification system will find about 9 percent of the "best" companies distressed (that is, 9 percent of the normal curve in the left tail as shown in figure 7-1). The average value for the "worst" fifteen NAWC companies is approximately 3.1 so that about 50 percent of the "worst" companies (that is, 50 percent of the left side of the normal curve) will have values of 3.1 or lower. While there is an overlapping region of "best" and "worst" companies, the value used to classify the truly distressed companies, 3.0, will capture most of them (as various experiments with the model have shown, including the use of 1985 and 1990 data for the strongest and weakest companies in various combinations). The only way to avoid this statistical and classification overlap is to have more than three classification categories. To keep the model and its interpretation simple, three categories were selected for this analysis.

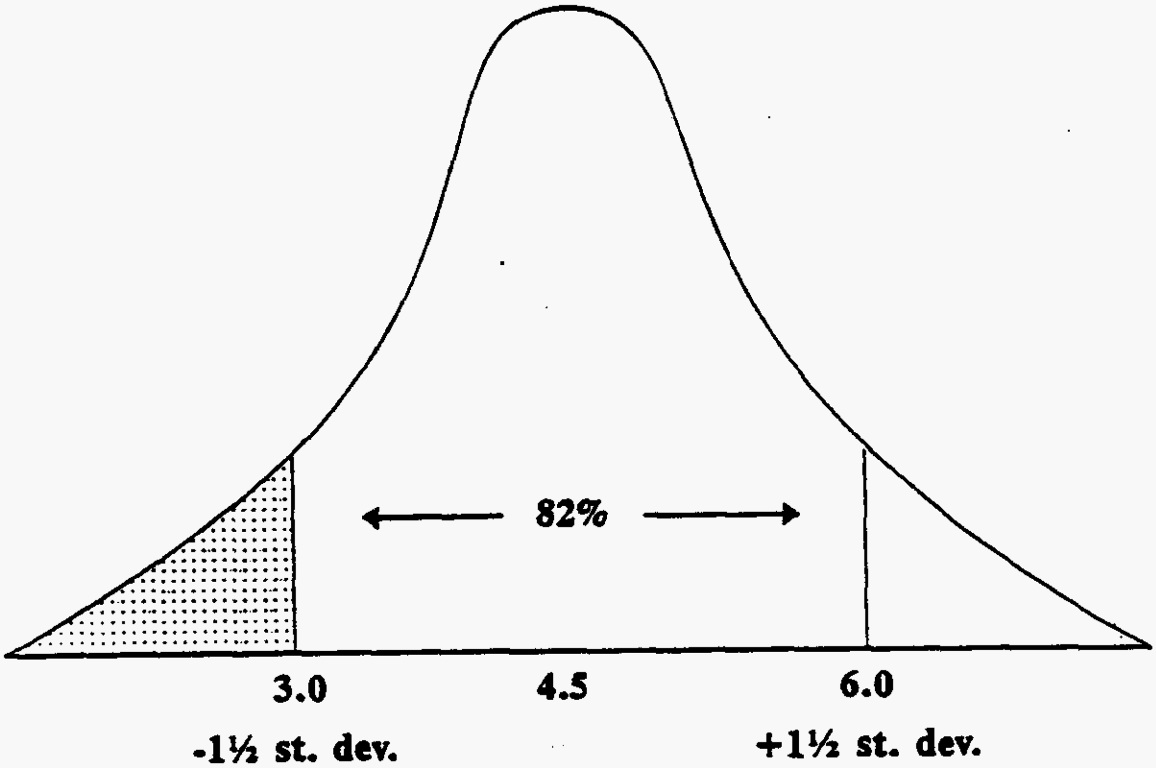

Fig. 6-1. Normal probability distribution (based on 15 "best" companies).

than 4.0 are likely to be in good condition. Those in between are weak or marginal depending on whether they are closer to 3.0 (weak) or 4.0 (good). Scores can be calculated for previous years to indicate the direction of distress. Some water companies have been distressed for years and are getting worse as the classification model will indicate.

The distress score approach was applied to the fifteen strong NAWC water companies and the fifteen weak ones as a check. Of the strong firms, ten were classified as "good," while five were classified as "marginal." Of the weak firms, two were classified as "good," five were classified as "marginal," and eight were found to be "distressed."

The model did not incorrectly rate any strong firm as distressed. Most weak firms were rated as weak or distressed. The high rating of two weak companies was due to an extremely high value for the indicator of liquidity (X2). This result occurred with two of the fifteen weak water companies in 1989 and in other simulations using data submitted by various commissions and of other randomly selected NAWC firms. In both cases the unusually high liquidity ratio was due to inordinately high accounts receivable or notes receivable. The high level of accounts receivable may in fact be a bad thing if they are old or uncollectible accounts, or note loans made by the firms or their owners that are uncollectible. After all, too much liquidity can be as harmful as too little. An example is when a firm has all of its investments in cash. In one of the two companies where the unusually high liquidity ratio was adjusted downward to a normal 1.5, the high rating of the weak firm disappeared.[33] The other firm had a strong earnings position and a strong liquidity position and is not really distressed, though its return on equity happened to be low in 1989.

Of the forty-five strong and weak firms used in the study (fifteen of each group for the years 1985, 1989, and 1990), the range of return on equity (ROE for 1989) was much greater than for the other years. That is why 1989 was chosen as the preferred model year. In applying the model to the forty-five best companies for the three years, only two of the forty-five were classified as distressed. In both cases, the ROE was not especially low and the companies had strong liquidity and earnings positions, and their operating efficiency (X6) was quite good. It would

[33] In deriving the model, the liquidity ratio (X2), was constrained to 3.0 for firms that exceeded 3.0 (three firms). The average liquidity ratio in the model is 1.70, which is close to the normal 1.5 used here.

not be appropriate to consider them financially distressed. This result indicates that the model cannot be interpreted automatically without attention to the individual ratios driving the results, particularly with respect to firms that show a healthy earnings trend and a strong equity cushion.

Application of the Model

Commission staff in three states provided financial data for selected small systems to test the proposed methodology. For reasons of confidentiality, the states are identified as A, B, and C and the individual jurisdictional water companies as One and Two. In the judgment of staff members, the utilities in states A and B all could be considered distressed; for state C one utility was considered distressed and one was considered viable. The data are for 1988 and 1989 and the results of the analysis are presented in table 6-4.

The seven-ratio classification technique appeared to work well. An exception was the need to adjust the liquidity ratio to the normal 1.5 for two systems, a problem discussed above. It was found that all of the systems, with the exception of the one from state C, were severely distressed from a financial standpoint. These distressed systems would probably file for bankruptcy protection in the nonregulated world; indeed, creditors would force them to do so.

Another test of the model is presented in table 6-5. Examined here are thirty-five water systems under one state's jurisdiction using data for 1990. The analysis reveals the disconcerting reality of widespread financial distress in the water utility industry. Using the distress classification scheme, only eleven systems could be considered in good to excellent financial health, while another four are marginal. Twenty systems could be classified as distressed and thirteen of these are technically bankrupt, based on the bankruptcy criteria described above. For illustrative purposes, financial data for one of the technically bankrupt firms appears in table 6-6.

In general, the distress classification model developed here should consistently identify water utilities that are currently distressed and in need of attention by regulators. The technique is similar to what could be accomplished in a statistically and empirically derived model such as the Altman or Platt and Platt models. The technique presented here is simpler and reasonably accurate for regulatory needs. The method seldom misclassifies strong companies as distressed (only two of

TABLE 6-4
VARIATIONS IN DISTRESS CLASSIFICATION SCORES

Company One	1988	1989	Company Two	1988	1989
State A					
X1	.160	.406	X1	.036	.024
X2	.726	.028	X2	.872	.973
X3	.133	-.009	X3	.072	.023
X4	-1.010	-1.040	X4	-.845	-4.440
X5	.709	.191	X5	.728	.741
X6	1.330	1.160	X6	.950	.932
X7	-.155	.076	X7	-.073	-.099
Distress Score	1.930	.808	Distress Score	1.740	-1.840
Classification: Distressed			Classification: Distressed		
State B					
X1	.083	-.045	X1	-.296	-.371
X2	7.640*	1.930	X2	-.028	-.007
X3	-.226	-.278	X3	-.093	-.222
X4	-1.030	-1.026	X4	-10.310	-4.880
X5	.157	.162	X5	1.740	.162
X6	.881	.788	X6	.768	.745
X7	-.135	-.268	X7	-.323	-.401
Distress Score	1.23	1.26	Distress Score	-8.54	-4.97
Classification: Distressed			Classification: Distressed		
State C					
X1	.014	.087	X1	na	.438
X2	.141	.141	X2	na	14.360*
X3	-.293	-.262	X3	na	.738
X4	-4.125	-4.950	X4	na	.244
X5	2.350	2.486	X5	na	.287
X6	1.093	1.192	X6	na	1.970
X7	-.049	.025	X7	na	.315
Distress Score	-.87	-1.281	Distress Score	na	5.49
Classification: Distressed			Classification: Good to Excellent		

Source: Calculated from data provided by state commissions. The identity of the companies is not revealed for confidentiality purposes.

* Liquidity ratio adjusted to normal 1.5.

TABLE 6-5
DISTRESS SCORES FOR ONE STATE'S WATER UTILITIES, 1990

	Number of Water Systems	
Good to excellent (4.0 or over)	11 (31%)	
Weak to marginal (3.0 to 3.99)	4 (11%)	
Distressed (3.0 or below)	20 (57%)	
Bankrupt (assets < liabilities)		13 (37%)
Total	35 (100%)	

Source: Analysis of water system annual reports.

TABLE 6-6
DISTRESS ANALYSIS OF A TECHNICALLY BANKRUPT WATER SYSTEM

Financial Indicator	Data	Calculation of Key Financial Ratios
Operating revenue	16.5	X1 = 0.024
Depreciation (book)	2.9	X2 = 1.500
Total operating expenses	19.4	X3 = -0.315
Net income	-2.5	X4 = -1.024
Total current assets	3.9	X5 = 0.178
Total assets	92.5	X6 = 0.851
Total current liabilities	0.8	X7 = -0.152
Total liabilities	121.0	
Retained earnings	-29.8	Total = 1.063
Total common equity	-29.1	
Total preferred equity	0.0	
Total equity	-29.1	
Total liabilities and equity	91.8	

Source: Analysis of one water system's annual report.

forty-five), but more importantly it appears consistently to identify truly weak and distressed water companies. At the very least, the analysis provides an objective initial indication of financial viability. The method can be readily performed using a computer spreadsheet program.

An important aspect of this technique is that it can be adapted to the particular needs and interests of the analysts. It is possible to construct a classification model, for example, based on a fewer number of ratios. If desirable, the ratios could be weighted to reflect the differential importance assigned to particular variables. All ten ratios could be used, as long as the analyst corrects for the fact that some ratios are positively related to failure, while those used in the model above are all inversely related to failure. Although the model developed here is considered generally valid, it may be possible to construct a classification scheme based on a different set of water systems. The referent group of water systems could be based on geographic considerations (such as all systems within a state or region), utility ownership (such as all investor-owned, municipality-owned, or cooperative systems), or some other criterion. Modifying the model in these ways, however, requires the analyst to recalculate the ranges used to define viable as opposed to distressed systems. In general, the resulting classification scheme would not be dramatically different.

Analyst judgment becomes essential when values for individual ratios fall outside of expected bounds. When this occurs, it is important to check for errors, identify the cause of the deviation, and determine whether it is a temporary anomaly or long term condition. An "off year" in sales, for example, can produce ratios affecting the entire classification system. A series of "off years" should trigger further investigation. In some cases, as long as the procedure is justified and well documented, it may be desirable to substitute normal values for statistically deviant ones.

In the regulated world, the finding of distress might trigger some other action to try to put an end to the system's persistent financial troubles. For many distressed systems, one or two financial ratios will identify the most serious problem areas. Knowing these problem ratios, specific problem areas can be identified, as illustrated in table 6-7. Rate relief may be the solution in some cases but not necessarily in others where, for example, an infusion of equity would improve the financial picture. For systems where most or all of the seven individual ratios signal distress, more drastic solutions are worth considering,

TABLE 6-7

POTENTIAL PROBLEM AREAS RELATED TO FINANCIAL DISTRESS FOR WATER UTILITIES

Ratio	Measurement	Potential Problem Areas
Profitability (X1)	Net income + depreciation / Annual operating revenues	· Rate adequacy · Depreciation rates · Sales trends · Expenses · Financial planning · Management capability
Liquidity (X2)	Current assets / Current liabilities	· Liabilities · Capitalization · Financial planning
Leverage (X3)	Common stock equity / Total assets	· Equity needs · Interest coverage ratios · Indebtedness
Profitability Trend (X4)	Retained earnings / Common stock equity	· Equity needs · Sales trends
Growth and Efficiency (X5)	Annual operating revenues / Total assets	· Rate adequacy · Asset turnovers · Sales trends
Efficiency and Profitability (X6)	Annual operating revenues / Annual operating expenses	· Sales trends · Rate adequacy · Financial planning · Management capability
Profitability (X7)	Net income / Annual operating revenues	· Rate adequacy · Sales trends · Financial planning · Management capability

Source: Authors' construct.

including the termination of the system's certificate and other means to force a merger, acquisition, or other structural alternatives. In the long term, persistent financial distress cannot be ignored.

It should be noted that the "best" companies in each year analyzed typically experienced an increase in their customer base (that is, economic growth). A significant number of these firms also received rate increases during the current or previous year, meaning their financial health was not affected by regulatory lag (that is, a delay in the recovery of costs or the inclusion of investments in the rate base). Absent economic growth, rate relief (assuming it is cost-based) is essential for the survival of distressed water companies.

One of the goals of this study was to develop a procedure or analytical technique that commissions could use when certifying new water companies to prevent their subsequent failure. At birth, key ratios do not exist for firms nor for newly certified water companies or newly chartered banks. However, it still makes sense to consider applying the distress classification method or a similar methodology to new systems during the certification process. In other words, new systems could be required to present projected financial ratios for the system's first year of operation, validated by data supporting the system's initial financial and rate structures. Because these projections are only best guesses, regulators must judge their reasonableness as well as rely heavily on judgments about capital adequacy, management experience, demographics of the service territory, and other factors. Trends in the actual ratios for new firms, particularly the profitability trends, could be monitored. Monitoring is especially important during the utility's early years of existence so that remedial measures can be taken if necessary.

There is no way to predict with certainty success or failure of a water system or of any new firm. Still, failure is guaranteed for many new small water systems since the ingredients for success are frequently absent: namely economic growth and management expertise. Operating margins shrink, earnings deteriorate, and the endless cycle of rate increases and negative net worth continues. Hard choices must be made in rejecting new applications for water utility certificates and finding a municipal or other nearby water delivery system for the home owners. The onus should be placed on developers to find alternate water supplies as some states are attempting to do. Otherwise proliferation will continue to be a threat and the failure of many small new water utilities will be predictable even without a model.

Another important application of the distress classification methodology is in evaluating structural alternatives for existing water systems, both those under distress and those that might be required to assume responsibility for water service under mandatory takeovers or other circumstances. As discussed in chapter 4, mergers, acquisition, satellite management, and other options for existing systems can be evaluated according to how they pass the least-cost, no-losers, and viability tests. Distress classification provides a means of assessing viability by comparing the current financial condition of systems with the expected outcome of a structural change. Ideally, for example, two weak utilities or a weak and a strong utility can be combined to make a stronger utility. However, if a prospective structural change is not likely to improve distress scores, its implementation should be reevaluated and either modified or abandoned in favor of an alternative that will result in measurable improvement in the well-being of the water utility or utilities involved.

CHAPTER 7

FUTURE DIRECTIONS

Signs of change for the water industry, and especially for its small systems component, can be seen. In many ways, this study has attempted to hit a moving target, as some significant water system viability policies have been adopted as recently as early 1992. The states clearly have found ways to address the serious problems of small water systems. Continued experimentation in this area is needed along with monitoring to assess the effectiveness of various policy alternatives. In addition to policy directions, several potential research directions also are identifiable.

Policy Directions

Following the basic framework that has guided this investigation, another representation of the institutional dimensions of viability--regulatory, structural, and comprehensive--appears in table 7-1. As shown, these viability dimensions vary in terms of the principal timeframe, tools, and goals involved in their application. In general, comprehensive solutions are of a long-term nature compared with the shorter timeframe required to implement regulatory solutions or the intermediate period needed to implement structural solutions. For each institutional dimension the principal tools also are somewhat different. The principal viability tool from a regulatory standpoint seems to be the certification process for emerging water systems, while the principal tool from a structural standpoint appears to be the consolidation of existing systems. Planning is the principal tool in more comprehensive policies.

In terms of principal goals, regulatory policies such as strengthened certification processes emphasize improving system *performance* along technical, financial, and managerial dimensions. Structural policies such as mergers and acquisitions go further in emphasizing *efficiency*. Economies of scale achievable through structural policies may be the most important financial resource available to the water supply industry as a whole. Finally, comprehensive policies, such as

TABLE 7-1

INSTITUTIONAL DIMENSIONS OF VIABILITY

Dimension	Principal TimeFrame	Principal Tools	Principal Goals
Regulatory	Short term	Certification	Performance
Structural	Intermediate term	Consolidation	Efficiency
Comprehensive	Long term	Planning	Viability

Source: Authors' construct.

integrated resource planning, emphasize the long-term goal of a more *viable* water-supply industry. These dimensions should be regarded as cumulative, such that the comprehensive strategies follow an accumulation of regulatory and structural strategies. Comprehensive policies are most complex in terms of implementation but also are expected to be most effective in the long term.

Clearly, the state regulatory process can go a long way to improve water system performance. The first step, certification, is the most important one in screening water system using viability criteria. The better the certification process for emerging systems, the fewer the problems once they have emerged. Thus establishing performance standards for emerging systems is critical for an overall state viability policy.

Beyond certification, regulatory oversight through monitoring and rate reviews can be used to improve the viability of some, but certainly not all, regulated firms. Next in the process the commission can consider consolidation strategies, such as mergers and acquisitions. Direct supervision and decertification become last resorts. Most experts agree, however, that even dedicated implementation of this regulatory model is not likely to result in 100 percent viability. As one expert has remarked, "All roads lead to restructuring."[1]

The states are beginning to exert more authority in restructuring the water supply industry. Most emerging water systems now must bear the burden of proof that structural alternatives to their creation are not feasible. Some policies go further in asserting that the absence of a structural alternative is not reason enough to obtain a certificate of convenience and necessity. A nonviable water system is not preferable to no water system at all. Long-term restructuring of the water supply industry can occur with the accumulation of newer and better knowledge. It depends on knowing the full range of structural alternatives and the institutional barriers to restructuring that might get in the way. Ultimately it may depend on the capability of the states to devise regulatory policy incentives (or remove disincentives) that make restructuring possible while protecting ratepayers and assuring they get their fair share of any economies.

Comprehensive policies take a global and long-term view, incorporating regulatory and structural policies along the way. One of the key instruments here is integrated water resource planning, broadly defined to encompass institutional planning processes such as those conducted by state governments. Integration among regulatory agencies is important as are least-cost planning principles in guiding decisions about the industry's future. Some recent policy developments seem to embrace a more comprehensive perspective and thus provide a framework for regulatory and structural policy alternatives as well. One could argue, for example, that true least-cost solutions to future water supply issues can be discovered only through a comprehensive approach that takes account of the full range of options, including alternative structures for providing them. For many communities, it may be impossible for small systems to meet least-cost and other planning criteria.

Based on these observations, a general typology of institutional policy alternatives for improving the viability of both emerging and existing water systems appears in table 7-2. As a matter of state policy, the immediate priority might be regulatory solutions, followed soon after by structural policies, and then comprehensive policies. However, the earlier the investment in long-term solutions, the earlier the returns.

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[1] John E. Cromwell, III of Wade Miller Associates, Inc. at an EPA sponsored seminar in Colorado Springs, September 1991.

TABLE 7-2

A GENERAL TYPOLOGY OF INSTITUTIONAL
POLICY ALTERNATIVES FOR IMPROVING WATER SYSTEM VIABILITY

	Emerging Systems	Existing Systems
Regulatory	Strengthen and improve use of the existing certification process and improve coordination among state agencies with certification authority	Improve the use of existing regulatory oversight processes, assistance, and simplification to improve water system performance
Structural	Explore and promote structural alternatives to the creation of new water systems in concert with local officials	Consider incentives to promote industry restructuring, especially consolidation, to create a more efficient water supply industry
Comprehensive	Integrate certification process with long-term water-resource and land-use planning for the states	Implement integrated water resource planning with an emphasis on creating a more viable water supply industry

Source: Authors' construct.

Several states now provide useful legislative policy models for viability policies. The evolution of Pennsylvania's viability policy is worth highlighting. House Bill No. 24 (Session of 1989) provided for acquisition adjustments in cases where acquisition costs are greater than depreciated original cost and spells out specific criteria for doing so. House Bill No. 26 (Session of 1991) provided for mandatory takeovers of small water utilities by a "capable public utility" after all other structural alternatives have been investigated. Finally, House Bill No. 1403 (Session of 1991) is the state's most comprehensive policy yet:

AN ACT providing for the establishment, implementation and administration of the small water systems technical, financial and management assistance program; providing for technical, financial and management assistance for small water systems; providing for the small water systems regionalization grant program; providing for financial assistance for comprehensive small water systems regionalization studies; imposing additional duties on the Department of Environmental Resources; authorizing the indebtedness, with the approval of the electors, of an additional $350,000,000 for loans for the acquisition, repair, construction, reconstruction, rehabilitation, extension, expansion and improvement of water supply, storm water control and sewage treatment systems; and transferring an appropriation.[2]

How Pennsylvania and other states have gotten to where they are today also is instructive. At the federal level, the U.S. Environmental Protection Agency has invested considerable effort in encouraging the states to improve their viability policies. EPA reports and workshops have provided guidelines for the development of state action plans to ensure small water system viability.[3] They emphasize developing a mission statement and implementation objectives for the state and a description of needed authorities and administrative resources. They also recommend that state policies specifically address water supply planning, permitting and review; assistance to small systems; and certification and licensing.

Consultants to Pennsylvania, Wade Miller Associates, Inc., prepared a viability study which placed an emphasis on comprehensive approaches. Their draft viability policy for state, which can readily be adapted to most any state, appears in table 7-3. The policy consists of five basic elements: control of new system development, coordination of authorities, improvements in assistance programs, development of a safety net program, and public education.

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2 *Pennsylvania House Bill No. 1403* (Session of 1991, passed March 16, 1992).

3 U.S. Environmental Protection Agency, *Establishing Programs to Resolve Small Drinking Water System Viability: A Summary of the Federal/State Workshop* (Washington, DC: U.S. Environmental Protection Agency, 1991).

TABLE 7-3

DRAFT VIABILITY POLICY STATEMENT FOR PENNSYLVANIA

A. Control the development of new nonviable systems by encouraging:

- A business plan for finances, management and operations.
- Performance guarantees.
- Annual financial reporting.
- Alternatives to stand-alone systems, such as interconnections, regionalization, mergers, etc.

B. Coordinate water supply planning by encouraging the use of existing municipal statutory authority at county, regional, and local levels to:

- Assure adequate customer base and financial compatibility.
- Encourage water system interconnections and water system compatibility.
- Enforce minimum standards for adequate yield, storage supply, and facility needs.
- Assure coordination planning and permitting activities.
- Foster wellhead protection, financial assurances, land-use planning and zoning to minimize water quality impacts and user costs.

C. Improve water supply regulatory and financial/technical assistance programs by:

- Developing a coordinated and consistent approach between DER and PUC to regulating community water systems and encouraging small system restructure.
- Focusing the financial/technical assistance efforts of agencies such as PENNVEST, DCA, Commerce, FmHA, and PRWA to promote consolidation, area-wide management and other restructuring schemes.
- Pursuing alternative mechanisms for state safe drinking water programs to provide sufficient resources to conduct effective regulatory control.
- Developing and adopting additional regulations and requirements to assure water system viability.

TABLE 7-3 (continued)

D. Develop a safety net program to deal with insolvent or abandoned water systems by:

- Structuring incentives for voluntary takeover by private entities.
- Utilizing existing statutes for municipal takeovers, bankruptcy, or receivership.

E. Provide a public education program for:

- Informing realtors, developers, investors and lending institutions about community water system viability issues.
- Enlightening the public about the problems with public water supply, the costs of providing an adequate supply of high-quality drinking water and the importance of a strong Safe Drinking Water Program in PA.
- Educating municipal officials about their authority under existing statutes to prevent proliferation.

Source: Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), 10-4 to 10-5.

Besides this outline, the Pennsylvania consultants also identified specific steps the state can take to improve small water system viability, as summarized in table 7-4. These steps are organized into four areas: new system viability screening, existing system viability screening, comprehensive planning, and sympathetic initiatives of state government. The last category, of course, is likely to be especially controversial because it calls for rethinking some traditional regulatory processes. Yet the recent legislative activities in the state indicate a fairly significant commitment among policymakers to take this step.

As a whole, the experiences in Pennsylvania and other states provide a good basis for the diffusion of policy innovations. Ideally, the next few years will see further experimentation with and refinement of the small system viability policies emerging today.

TABLE 7-4

PROPOSED VIABILITY INITIATIVES FOR PENNSYLVANIA

New System Viability Screening

Initial Steps

- Implement cost analysis and alternatives analysis elements of the new system screening process on an interim, voluntary basis.
- Modify DER regulations to redefine the scope of the Engineers Report to require expanded cost and alternatives analyses.
- Establish a permitting and certification work group to begin to develop coordination protocols between new system approval processes.

Ultimate Steps

- Convene a legal and policy review work group to draft legislative proposals to support full implementation of the new system viability screening process.

Existing System Viability Screening

Initial Steps

- Convene an interagency work group to assess the proposal to adapt the PENNVEST application process as a viability screening mechanisms.
- Specify the details for the business plan requirement for existing systems and evaluate the mechanics of integrating the business plan requirement with the PENNVEST application process.

Ultimate Steps

- Implement the business plan requirement as a component of the PENNVEST application process, accompanied by a Management Assistance Program for Small Systems.
- Assess prospects for utilizing currently available annual financial reports as a third-tier viability screen.

TABLE 7-4 (continued)

Comprehensive Planning

Initial steps

- Demonstrate and refine the planning process
- Structure DER, PUC, and PENNVEST Viability Policy Statements to provide incentives to comprehensive water supply planning.

Ultimate steps

- Draft a legislative proposal for a statewide planning mandate at the county level, including provision for funding and technical assistance, following the model of stormwater management law.

Sympathetic Initiatives of State Government

Initial Steps

- Develop individual viability policy statements for DER, PENNVEST, and the PUC as well as an umbrella policy statement defining the continuing functions of the interagency viability steering committee.
- Evaluate the potential for sympathetic modification in the DER Water Allocation Permit process.
- Evaluate the potential for sympathetic modifications in PUC regulation of rates and finances.
- Evaluate the potential to implement a coordinated state initiative to promote contract O&M for small systems.
- Develop targeted public information campaigns to cover two groups: 1) homeowners, home buyers, mobile home park tenants, and the banking community; and 2) water system developers, owners, and managers.

Ultimate Steps

- Assess additional needs for takeover authority to provide a safety net for systems unable to attain viable status by other means.

Source: Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), chapter 11.

Research Directions

This research endeavor has shown that performance assessment, including distress classification, can play a role in developing and implementing viability policies for water utilities. Despite limitations, performance assessment is especially critical for emerging water systems. Water system certification should be rigorous, thorough, and restrictive when necessary. Existing systems, too, should be screened along various performance criteria. As a diagnostic tool, performance assessment can assist regulators in identifying cases where intervention is justified. Another application for existing systems is the use of performance assessment in evaluating prospective structural changes, such as mergers and acquisitions. Policy institutions also should be periodically subjected to performance evaluations so that appropriate institutional modifications can be made. Many states have recognized this need.

Future public policy will benefit from further research efforts on small system issues as well as the water industry as a whole. It would seem appropriate that the research effort should turn next to questions about structure, such as:

- How effective are today's emerging viability policies in achieving desired structural outcomes?
- What is the optimal water system size and what is the optimal industry structure?
- What will be the roles of investor-owned and publicly owned systems in a restructured water supply industry?
- What is the appropriate ownership structure for regional water utilities?
- What are the opportunities for vertical as opposed to horizontal restructuring of the water supply industry?
- What is the appropriate role of privatization, such public ownership with contractual management and operations with a private firm?
- How can market-based mechanisms such as competitive bidding be appropriately introduced to the water supply industry?
- How does a community's ability to pay affect structural choices?
- How can comprehensive policies such as integrated water resource planning further restructuring goals?
- How do politics impede improvement of the water industry's viability and how can these forces be overcome?

While few of the affected parties may agree, the pressure on the water supply industry brought to bear by today's more stringent regulatory standards and other forces could in the long term have a positive effect in terms of restructuring the industry in ways that enhance its performance, efficiency, and viability. Further research can serve to confirm or refute this hypothesis. The role of small systems in the industry's future is uncertain, but can only improve with the types of informed and strategic policymaking now underway.

APPENDIX A

1991 NRRI SURVEY ON WATER SYSTEM VIABILITY

TABLE A-1
JURISDICTIONAL WATER UTILITIES BY STATE, 1990

State Commission	Total Jurisdictional Utilities(a)	Total Investor-Owned Utilities(a)	Total Small Utilities(b)
Alabama	13	13	13
Alaska	65	21	22
Arizona	409	378	365
Arkansas	3	3	2
California	225	225	190
Colorado	5	5	5
Connecticut	61	61	52
Delaware	14	14	12
Florida	812*	357	339
Hawaii	11	11	11
Idaho	23	23	16
Illinois	55	55	41
Indiana	375	23	176
Iowa	1	1	0
Kansas	7	7	7
Kentucky	212	36	191
Louisiana	116	116	109
Maine	155	38	116
Maryland	28	28	23
Massachusetts	38	37	30
Michigan	21	1	20
Mississippi	144	71	109
Missouri	78	78	71
Montana	152	35	135
Nevada	23	23	20
New Hampshire	41	40	36
New Jersey	77	64	68
New Mexico	38	38	35
New York	2,677	317	303
North Carolina	1,485*	336	332
Ohio	35	35	25
Oklahoma	30	30	30
Oregon	6	6	4
Pennsylvania	336	269	184
Rhode Island	na	7	1

TABLE A-1 (continued)

State Commission	Total Jurisdictional Utilities(a)	Total Investor-Owned Utilities(a)	Total Small Utilities(b)
South Carolina	72	72	67
Tennessee	9	9	6
Texas	4,707	1,402	1,385
Utah	330	33	329
Vermont	80	80	80
Virginia	70	70	68
Washington	60	60	56
West Virginia	413	58	266
Wisconsin	558	12	385
Wyoming	16	16	16

Source: *1991 NRRI Survey of Commission Regulation of Water Systems.* Some numbers are approximations.

* Water systems

(a) Definitions may vary.
(b) Systems serving under 3,300 customers or 1,000 connections.

na = not applicable or not available.

TABLE A-2

JURISDICTIONAL WATER SYSTEMS WITH NEGATIVE NET INCOME AND NEGATIVE NET WORTH, 1991

State Commission	Small Systems With Negative Net Income(a)	Small Systems With Negative Net Worth(b)	State Commission	Small Systems With Negative Net Income(a)	Small Systems With Negative Net Worth(b)
Alabama	6	6	New Hampshire	1	0
Alaska	7	0	New Jersey	25	28
Arizona	226	91	New Mexico	7	15
Arkansas	0	0	New York	na	na
California	25	0	North Carolina	na	na
Colorado	0	0	Ohio	10	11
Connecticut	10	9	Oklahoma	11	0
Delaware	5	0	Oregon	0	0
Florida	462	39	Pennsylvania	91	55
Hawaii	8	6	Rhode Island	na	na
Idaho	12	7	South Carolina	na	23
Illinois	22	9	Tennessee	4	3
Indiana	90	90	Texas	291	na
Iowa	na	na	Utah	60	15
Kansas	5	5	Vermont	50	0
Kentucky	95	2	Virginia	na	na
Louisiana	58	58	Washington	21	9
Maine	na	na	West Virginia	na	na
Maryland	18	7	Wisconsin	103	52
Massachusetts	17	6	Wyoming	7	0
Michigan	0	0			
Mississippi	45	25			
Missouri	0	0			
Montana	100	na			
Nevada	15	18			

Source: *1991 NRRI Survey on Commission Regulation of Water Systems.*

(a) Approximate number of small systems (under 3,300 customers or 1,000 connections) having a negative net income (losses) in two of the last three years.

(b) Approximate number of small systems (under 3,300 customers or 1,000 connections) having a negative net worth at the time of the survey.

TABLE A-3

CERTIFICATION OF WATER SYSTEMS, 1990

State Commission	Systems Requesting Certification	Systems Receiving Certification	State Commission	Systems Requesting Certification	Systems Receiving Certification
Alabama	3	3	New Hampshire	4	4
Alaska	0	0	New Jersey	0	1
Arizona	4	2	New Mexico	2	2
Arkansas	0	0	New York	48	15(c)
California	0	0	North Carolina	30	30
Colorado	0	0	Ohio	3	1
Connecticut	15-20(a)	15-20(a)	Oklahoma	(b)	(b)
Delaware	1	1	Oregon	(b)	(b)
Florida	16	15	Pennsylvania	6	5
Hawaii	1	1	Rhode Island	na	na
Idaho	1	2	South Carolina	4	4
Illinois	0	0	Tennessee	2	1
Indiana	0	0	Texas	54	54
Iowa	(b)	(b)	Utah	0	0
Kansas	0	0	Vermont	0	0
Kentucky	0	0	Virginia	4	4
Louisiana	8	7	Washington	3	3
Maine	0	0	West Virginia	72	73
Maryland	1	1	Wisconsin	1	1
Massachusetts	0	na	Wyoming	0	0
Michigan	1	1			
Mississippi	3	3			
Missouri	5	4			
Montana	0	0			
Nevada	1	1			

Source: *1991 NRRI Survey on Commission Regulation of Water Systems.* Systems requesting certification and systems receiving certification may not be comparable because of cases carried over from one year to the next. Some numbers are approximations.

(a) Certification process for small water systems that are not regulated water companies. These systems serve over 25 individuals or have 25 service connections.
(b) The commission or board has no certification authority.
(c) One certification request was not approved and 32 were pending at the time of the survey.

TABLE A-4

STATE CONSIDERATION OF WATER SYSTEM VIABILITY

State Commission	Addressed by Statute (a)	Considered in Certification (b)	Interagency Coordination (c)	Viability Defined (d)
Alabama	no	yes	yes	no
Alaska	no	yes	yes	no
Arizona	no	yes	yes	no
Arkansas	no	yes	na	no
California	yes	yes	yes	yes
Colorado	no	yes	no	no
Connecticut	yes	yes	yes	yes
Delaware	no	yes	yes	no
Florida	no(e)	yes	yes	yes
Hawaii	no	yes	yes	no
Idaho	no	yes	yes	no
Illinois	no	yes	yes	yes
Indiana	no	no	no	no
Iowa(f)	na	na	na	na
Kansas	no	yes	no	yes
Kentucky	no	yes	yes	no
Louisiana	no	no	yes	no
Maine	no	yes	no	no
Maryland	no	yes	yes	no
Massachusetts	no	no(g)	no(h)	yes(i)
Michigan	no	yes	yes	yes
Mississippi	no	yes	yes	no
Missouri	no	yes	yes	no
Montana	no	no	no	no
Nevada	no	no	no	no
New Hampshire	no	yes	yes	yes
New Jersey	yes	yes	yes	no
New Mexico	no	yes	yes	yes
New York	no	yes	yes	no
North Carolina	yes	yes	yes	no
Ohio	no	yes	yes	no
Oklahoma	no	(f)	(f)	no
Oregon	no	(f)	(f)	no
Pennsylvania	no	yes	yes	no
Rhode Island	no	yes	na	no

TABLE A-4 (continued)

State Commission	Addressed by Statute (a)	Considered in Certification (b)	Interagency Coordination (c)	Viability Defined (d)
South Carolina	no	yes	yes	no
Tennessee	no	yes	yes	yes
Texas	yes	yes	yes	no
Utah	no	yes	yes	yes
Vermont	no	yes	yes	no
Virginia	no	yes	yes	no
Washington	yes	no	no	no
West Virginia	no	yes	yes	no
Wisconsin	no	yes	yes	yes
Wyoming	yes	yes	yes	no

Source: *1991 NRRI Survey of Commission Regulation of Water Systems.*

(a) State statute addressing viability of small water systems
(b) Commission considers financial viability in the certification process.
(c) Certification of new systems is coordinated with the state drinking water administrator (e.g., Environmental Protection or Health Agency).
(d) Commission has defined a nonviable water system.
(e) A state statute addresses wastewater system viability. Commission rules address water system viability.
(f) The commission or board has no certification authority.
(g) Department of Environmental Protection regulations require examination of viability.
(h) Informal arrangement exists between the Department of Public Utilities and the Department of Environmental Protection; at the time of the survey, this procedure was about to be formalized.
(i) Defined in the Department of Environmental Protection legislation.

na = not applicable or not available.

TABLE A-5

COMMISSION USE OF CERTIFICATION TO ASSURE VIABILITY

State Commission	Stronger Process (a)	Certificates Denied (b)	State Commission	Stronger Process (a)	Certificates Denied (b)
Alabama	no	no	New Hampshire	yes	no
Alaska	no	no	New Jersey	no	yes
Arizona	yes	yes	New Mexico	no	no
Arkansas	no	no	New York	no	no
California	yes	yes	North Carolina	yes	no
Colorado	no	no	Ohio	no	no
Connecticut	yes	yes	Oklahoma	(c)	(c)
Delaware	yes	no	Oregon	(c)	(c)
Florida	yes	yes	Pennsylvania	no	no
Hawaii	no	no	Rhode Island	yes	no
Idaho	yes	no	South Carolina	yes	no
Illinois	no	no	Tennessee	yes	no
Indiana	no	no	Texas	yes	no
Iowa	(c)	(c)	Utah	yes	no
Kansas	no	no	Vermont	yes	no
Kentucky	no	no	Virginia	yes	yes
Louisiana	no	no	Washington	no	no
Maine	no	no	West Virginia	no	yes
Maryland	yes	no	Wisconsin	no	no
Massachusetts	no	no	Wyoming	yes	yes
Michigan	no	no			
Mississippi	no	no			
Missouri	no	no			
Montana	no	no			
Nevada	yes	no			

Source: *1991 NRRI Survey on Commission Regulation of Water Systems.*

(a) States that have strengthened certification to help ensure water system viability.
(b) States that have denied certification on the basis of the viability issue.
(c) The commission or board has no certification authority.

TABLE A-6
MERGERS, ACQUISITIONS, AND CESSATION OF WATER SYSTEM OPERATIONS, 1990

State Commission	Number of Mergers	Number of Acquisitions	Number of Systems Ceasing Operations for Financial Reasons
Alabama	2	0	0
Alaska	1	0	0
Arizona	0	18	0
Arkansas	0	0	0
California	6	6	1
Colorado	0	0	0
Connecticut	-	3	3
Delaware	0	0	0
Florida	4	10	1
Hawaii	0	0	0
Idaho	0	0	0
Illinois	0	3	0
Indiana	2-3	0	0
Iowa	na	na	na
Kansas	0	1	0
Kentucky	0	6	0
Louisiana	5(a)	(a)	1
Maine	0	2	0
Maryland	0	2	0
Massachusetts	0	1	1
Michigan	1	1	0
Mississippi	0	4	0
Missouri	0	2	0
Montana	0	1	0
Nevada	0	0	0
New Hampshire	1	1	0
New Jersey	1	1	0
New Mexico	0	2	1
New York	0	5	0
North Carolina	1	90	20
Ohio	1	0	0
Oklahoma	0	0	0
Oregon	0	2	1
Pennsylvania	0	11	5
Rhode Island	na	na	na

TABLE A-6 (continued)

State Commission	Number of Mergers	Number of Acquisitions	Number of Systems Ceasing Operations for Financial Reasons
South Carolina	2	2	6
Tennessee	0	1	1
Texas	0	70	6
Utah	0	0	0
Vermont	2	3	0
Virginia	0	2	0
Washington	0	0	0
West Virginia	2	4	1
Wisconsin	0	0	0
Wyoming	0	0	0

Source: *1991 NRRI Survey of Commission Regulation of Water Systems.* Sme numbers are approximations.

(a) Mergers and acquisitions are considered the same.

na = not applicable or not available.

TABLE A-7

CHANGE IN THE NUMBER OF INVESTOR-OWNED WATER UTILITIES, 1980-1990

State	1980	1985	1990	1980-1990	1985-1990
Alabama	17	13	13	-4	0
Alaska*	24	24	21	-3	-3
Arizona*	475	390	378	-97	-12
Arkansas	12	10	3	-9	-7
California*	346	270	225	-121	-45
Colorado	12	10	5	-7	-5
Connecticut	106	100	61	-45	-39
Delaware	14	14	14	0	0
Florida(a)	260	285	357	+97	+72
Hawaii	8	8	11	+3	+3
Idaho	22	22	23	+1	+1
Illinois	73	57	55	-18	-2
Indiana*	123	24	23	-100	-1
Iowa	15	3	1	-14	-2
Kansas	7	7	7	0	0
Kentucky	46	41	36	-10	-5
Louisiana	144	152	116	-28	-36
Maine	61	38	38	-23	0
Maryland	60	29	28	-32	-1
Massachusetts	51	51	37	-14	-14
Michigan	18	18	1	-17	-17
Mississippi	108	93	71	-37	-22
Missouri	75	75	78	+3	+3
Montana	27	24	35	+8	+11
Nevada	13	24	23	+10	-1
New Hampshire	31	26	40	+9	+14
New Jersey	88	77	64	-24	-13
New Mexico	30	47	38	+8	-9
New York	491	465	317	-174	-148
North Carolina(b)	343	317	336	-7	+19
Ohio	42	35*	35	-7	0
Oklahoma	46	33	30	-16	-3
Oregon	25	24*	6	-19	-18
Pennsylvania	345	285	269	-76	-16
Rhode Island	8	8	7	-1	-1

TABLE A-7 (continued)

State	1980	1985	1990	1980-1990	1985-1990
South Carolina	52	58	72	+20	+14
Tennessee	13	9	9	-4	0
Texas(c)	445	628	1,402	+957	+774
Utah	18	16	33	+15	+17
Vermont	71	71	80	+9	+9
Virginia	73	76	70	-3	-6
Washington	55	58	60	+5	+2
West Virginia	70	51	58	-12	+7
Wisconsin	15	12	12	-3	0
Wyoming	17	13	16	-1	+3
Total	4,395	4,091	4,614	+219	+523
Totals without Texas	3,950	3,463	3,212	-738	-251

Source: National Association of Regulatory Utility Commissioners, *NARUC Annual Report on Utility and Carrier Regulation 1980* and *1985* (Washington, DC: National Association of Regulatory Utility Commissioners, 1981 and 1986); and *1991 NRRI Survey of Commission Regulation of Water Systems.*

* Estimate.

(a) Florida distinguishes water systems (812 in 1990) from water companies and reports companies.
(b) North Carolina reports water companies, not systems.
(c) As of 1990, the authority of the Texas Water Commission extended to 4,707 community water systems, of which 1,402 were considered "active" and included in this table.

APPENDIX B

COMMISSION RULES CONCERNING WATER SYSTEM VIABILITY

CONNECTICUT

Rules of the Department of Public Utility Control
Section 16-262m-9

(a) If the Department of Public Utility Control and Department of Health Services determined that a main extension is not feasible or no utility is willing to extend such main, and that no existing regulated public service or municipal utility or regional water authority is willing to own, operate and maintain the final constructed water supply facilities as a non-connected, satellite system, and if it is not feasible to install private individual wells, the applicant may continue forward with the application by satisfactorily providing the following additional information:

(1) A description of the applicant's business organization along with certified copies of the executed documents or any authority granted pursuant to Section 2-20a of the General Statutes of Connecticut;

(2) Certified copy of most current 12-month balance sheet and income statement of proposed owner of water system including a statement of current assets and liabilities;

(3) Copy of most current income tax return of proposed owner of water system;

(4) Indicated source of financial resources that would be used to fund the daily operations and any needed future capital improvements;

(5) Describe the financial ability of the proposed owner of the water system to provide a continuous, adequate and pure supply of water in routine and emergency situations including a pro forma cash flow statement for one year starting immediately after construction is completed;

(6) Describe the annual budget formulation process;

(7) Indicate the name, address, and qualifications of person/company who will be responsible for the budget preparation and administration;

(8) Describe the controls that will be in place to keep operations within budget and the sanctions or consequences that there will be for budget overruns;

(9) Indicate the name and address of person responsible for filing tax returns and annual audit reports;

(10) Indicate the name and address of person(s)/company(s) who will be responsible for routine operations including maintenance, customers billing and collections, repairs, emergency service and daily management;

(11) Describe the planning process to be implemented and assignment of responsibilities to provide for future needs of the customers including a program for routine system maintenance and the increase of future supplies as may be necessary;

(12) Describe the technical background and experience of the proposed operator including any membership in professional water industry organizations;

(13) Furnish a signed agreement or contract under which the proposed operator will serve, including guarantee of continuous long-term operation;

(14) Indicate the name and address of person/company who will manage the water system if different from operator;

(15) If there will be a business manager, in addition to the operator, describe his or her qualifications;

(16) Describe the governing board, its background in utility business governance and the decision making process of the management entity;

(17) List items which the operator will be responsible for and those which the manager will be responsible for;

(18) A plan for conducting cross-connection investigations including identification of the personnel capable of conducting cross-connection inspections;

(19) A plan (including the procedures, methods, schedule and location) for conducting required sampling, testing and reporting regarding: (A) water quality testing; (B) pressure testing; (C) production metering; (D) customer meter testing; (E) ground water monitoring pursuant to Section 19-13-B102(n) of the Regulation of Connecticut State Agencies;

(20) A plan for maintenance of the system;

(21) A plan for the maintenance of required records including at least:

(A) service area maps; (B) water quality, pressure, metering and other tests; (C) emergency procedures; (D) metering; (E) energy use; (F) chemical use; (G) water levels; (H) production and consumption; (I) customer complaints; (J) non-revenue water; (K) all financial records;

(22) A plan for operator safety;

(23) A plan for leak detection;

(24) A plan for long range conservation including supply and demand management practices;

(25) A plan for action and proper notification of authorities in the event of an emergency;

(A) As used above, "emergency" means any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought or fire, explosion, electrical outage, toxic spill or attack or series of attacks by enemy of the United States causing, or which may cause, substantial damage or injury to civilian property or persons in the United States in any manner by sabotage or by the use of bombs, shellfire or atomic, radiological, chemical, bacteriological or biological means or other weapons or processes.

(26) Estimated itemized cost of water facilities to be constructed or expanded.

(b) In addition to the above requirements, the Department of Public Utility Control shall be furnished the proposed owner's plans for the following:

(1) Preparation of adequate rules and regulations for providing water service, including termination of customers for non-payment of bills;

(2) Preparation and administration of a proper metered rate schedule and the rates themselves;

(3) A procedure for handling customer complaints;

(4) A procedure for meter reading and accurate billing of customers;

(5) A listing in the local telephone directory of an emergency and general inquiry telephone number for the customers.

Purpose: The purpose of these regulations is to allow the Department of Public Utility Control and the Department of Health Services to implement jointly the provisions of General Statutes of Connecticut 16-262m, which was enacted to address the difficulties associated with the construction or expansion of small water systems, such as inadequate construction and financing, which ultimately leads to inadequate levels of service provided by such water companies.

These Regulations are intended to restrict the proliferation of new small water systems, to promote good public utility practices, to encourage efficiency and economy, to deliver potable water in accordance with applicable health standards, and to establish minimum standards to be hereafter observed in the design, construction and operation of waterworks facilities of new small water systems and on which existing community water systems should base their future plans should they choose to expand. The Certificate of Public Convenience and Necessity assures town governments that community water systems will operate in accordance with the general requirements and applicable minimum standards of Sections 16-11-50 through 16-11-97, inclusive and Sections 19-13-B32, 19-13-B51, 19-13-B46, 19-13-B47 and 19-13-B102 of the Regulations of Connecticut State Agencies.

FLORIDA

Rules of the Florida Public Service Commission
Water and Sewer Provisions

25-30.033 Application for Original Certificate of Authorization and Initial Rates and Charges.

(1) Each application for an original certificate of authorization and initial rates and charges shall provide the following information:

(a) the applicant's name and address;

(b) the nature of the applicant's business organization, i.e., corporation, partnership, limited partnership, sole proprietorship, association, etc.;

(c) the name(s) and address(es) of all corporate officers, directors, partners, or any other person(s) owning an interest in the applicant's business organization;

(d) whether the applicant has made an election under Internal Revenue Code 1362 to be an S corporation;

(e) a statement showing the financial and technical ability of the applicant to provide service, and the need for service in the proposed area. The statement shall identify any other utilities within a 4-mile radius that could potentially provide service, and the steps the applicant took to ascertain whether such other service is available;

(f) a statement that the provision of service will be consistent with the water and wastewater sections of the local comprehensive plan, as approved by the Department of Community Affairs, or, if not, a statement demonstrating why granting the certificate of authorization would be in the public interest.

(g) the date applicant plans to begin serving customers;

(h) the number of equivalent residential connections (ERCs) proposed to be served, by meter size and customer class. If development will be in phases, separate this information by phase;

(i) a description of the types of customers anticipated, i.e., single family homes, mobile homes, duplexes, golf course clubhouse, commercial, etc.;

(j) evidence, in the form of a warranty deed, that the utility owns the land upon which the utility treatment facilities are or will be located, or a copy of an agreement which provides for the continued use of the land, such as a 99-year lease. The applicant may submit a contract for the purchase and sale of land with an unexecuted copy of the warranty deed, provided the applicant files an executed and recorded copy of the deed, or executed copy of the lease, within thirty days after the order granting the certificate;

(k) one original and two copies of a sample tariff, containing all rates, classifications, charges, rules, and regulation, which shall be consistent with Chapter 25-9, Florida Administrative Code. Model tariffs are available from the Division of Water and Wastewater, 101 East Gaines Street, Tallahassee, Florida 32399-0870;

(l) a description of the territory to be served, using township, range and section references;

(m) one copy of a detailed system map showing the proposed lines, treatment facilities and the territory proposed to be served. The map shall be of sufficient scale and detail to enable correlation with the description of the territory proposed to be served;

(n) one copy of the official county tax assessment map, or other map showing township, range, and section with a scale such as 1"=200' or 1"=400', with the proposed territory plotted thereon by use of metes and bounds or quarter sections, and with a defined reference point of beginning.

(o) a statement regarding the separate capacities of the proposed lines and treatment facilities in terms of ERCs and gallons per day. If development will be in phases, separate this information by phase;

(p) a written description of the type of water treatment, wastewater treatment, and method of effluent disposal;

(q) if (p) above does not include effluent disposal by means of spray irrigation, a statement that describes with particularity the reasons for not using spray irrigation;

(r) a detailed statement (balance sheet), certified if available, of the financial condition of the applicant, that shows all assets and liabilities of every kind and character. The statement shall be prepared in accordance with Rule 25-30.115, Florida Administrative Code;

(s) a statement of profit and loss (operating statement), certified if available, of the applicant for the preceding calendar or fiscal year. If an applicant has not operated for a full year, then for the lesser period;

(t) a list of all entities which have provided, or will provide funding to the utility, their financial statements or copies of any financial agreements;

(u) a cost study including customer growth projections supporting the proposed rates, charges and service availability charges. A sample cost study, and assistance in preparing initial rates and charges, are available from the Division of Water and Wastewater;

(v) a schedule showing the projected cost of the proposed system(s) by NARUC account numbers and the related capacity of each system in ERCs and gallons per day. If the utility will be built in phases, this shall apply to the first phase;

(w) a schedule showing the projected operating expenses of the proposed system by NARUC account numbers, when 80 percent of the designed capacity of the system is being utilized. If the utility will be built in phases, this shall apply to the first phase; and

(x) a schedule showing the projected capital structure including the methods of financing the construction and operation of the utility until the utility reaches 80% of the design capacity of the system.

Specific Authority: 367.031, 367.045, F.S.
History: New 1/27/91.

Ohio Administrative Code Chapter 4901
Sewage Disposal System Companies and Water Works System Companies

4901:1-15-02 Application for certificate of public convenience and necessity

(A) Any person, firm or corporation desiring to obtain a certificate of public convenience and necessity authorizing such person, firm, or corporation to construct and/or operate a sewage disposal system and/or a water supply system, or to expand the area in which such a system is operated, shall file an application in the form and with the content specified in this rule. Exhibits as described and enumerated in rule 4901:1-15-01 of the Administrative Code shall be attached to and made a part of each application.

(B) All applications and exhibits shall be typewritten, printed or reproduced by some other equally legible and permanent process on good quality paper, eight and one-half inches by eleven inches, nominal size. Maps and plans may be reproduced by any reasonably permanent process and shall be of such size that they can be folded to match the other documents presented.

(C) Fourteen copies of applications and exhibits (one original and thirteen conformed copies) shall be filed and must be signed in ink by the applicant or his attorney and shall show the complete post office address of the person whose signature is affixed. If the applicant is a partnership, one partner may sign for all; if a corporation, the president, a vice president, secretary or other duly authorized officer shall sign. The applicant shall serve a copy of the application, the exhibits and all other filings upon the Ohio environmental protection agency (OEPA) at Columbus, Ohio. Any of the exhibits which are otherwise required to be filed with OEPA may be omitted from such filing.

(D) The following exhibits shall be filed with each applicant and presented as evidence at the hearing.

(1) As exhibit (1)

(a) If applicant is a corporation:

(i) A list of the officers, directors and the ten largest shareholders of the corporation, the address of each and the number of shares held by each. If there are not as many as ten shareholders, a statement to that effect shall be part of the exhibit.

(ii) The nature, character and extent of the interest, if any, of any of the said officers, directors, or shareholders in any other sewage disposal system and/or shareholders in any other sewage disposal system and/or waterworks company, or in any other firm or corporation that holds an interest in any other sewage disposal system and/or waterworks system company; or

(b) If applicant is a partnership:

(i) Name and address of each partner:

(ii) The nature, character and extent of the interest, if any, of any partner in any other sewage disposal system and/or waterworks company, or in any other partnership or corporation that holds any interest in any other sewage disposal system and/or waterworks company; or disposal system and/or waterworks company, or

(c) If the applicant is an individual: The same information for an individual owner of a sewage disposal system or a waterworks system required by paragraphs (D)(1)(b)(i) and (D)(1)(b)(ii) of this rule for a partnership application.

(d) If any person, firm or corporation purports to guarantee the obligations of the applicant, a disclosure including:

(i) Identification of such person, firm or corporation by name and complete post office address:

(ii) A detailed balance sheet (net worth statement) for such person, firm or corporation.

(e) Further, if any developer of all or part of the area for which applicant requests a certificate of public convenience and necessity has any interest in, or control over, the applicant, a disclosure including:

(i) Identification of such developer by name and complete post office address:

(ii) A detailed balance sheet (net worth statement) of such developer.

(iii) The nature and extent of such developer's interest in applicant and/or the means by which control is exercised over applicant.

(2) As exhibit (2)
A certified copy of the articles of incorporation and amendments thereto if applicant is a corporation, or a copy of the partnership agreement if applicant is a partnership.

(3) As exhibit (3)
A financial statement (balance sheet) showing in detail applicant's assets, liabilities and net worth as of the date no more than one month previous to the date the application was filed. At the hearing, applicant shall tender an amended financial statement showing in detail applicant's assets, liabilities and net worth as of the date the application was filed.

(4) As exhibit (3a)
A similar financial statement (balance sheet) showing applicant's assets, liabilities and net worth projected to exist at the date upon which construction will be completed and the system or systems will be ready for operation.

(5) As exhibits (4) and (4a)
Pro forma income statements for applicant's first (exhibit 4) and fifth (exhibit 4a) contemplated full years of operation, showing in reasonable detail for each of those years applicant's anticipated operating revenues, expenses and net income available for fixed charges.

(6) As exhibit (5)
A multi-page document (tariff) setting forth all of applicant's proposed rates, charges, and rules and regulations. This document shall be considered by the commission in its determination of applicant's ability to operate the proposed sewage disposal and/or waterworks system(s) at rates and charges that will produce from such operations a fair and reasonable rate of return on the statutory rate base value of the property dedicated to the service of the public. Such tariff documents tendered to the commission as exhibits to an application shall bear no issued nor effective dates and their form and content shall be subject to approval by the commission.

(7) As exhibit (6)
A map of the area in which service is to be rendered pursuant to the authority sought. Such map shall be prepared by an engineer registered to practice in Ohio and shall show all mains and laterals to be incorporated into applicant's sewage disposal system and/or waterworks system and their relation to the lots or plots of ground to be served; the size (diameter) of pipe to be used for each segment of such system; the proposed location of any sewage treatment plant and any lift station; the proposed location of waterworks pumping stations and any booster pumps needed to maintain proper pressure in the system. A map offered as exhibit (6) to any application shall be drawn or reproduced to scale, and must be sufficiently large to be readable. The scale shall be shown in a written statement or by a legend on the map. The map shall also bear a title block indicating the name of the owner of the system or systems shown thereon, the type or types of system(s) shown, the date of preparation of the map and the name and Ohio registry number of the engineer responsible for its accuracy and completeness.

(8) As exhibit (7)

(a) A written description of the proposed sewage disposal system and/or waterworks system and the component parts thereof prepared by a registered engineer licensed to practice in Ohio. The description shall include, but not be limited to, statements of the maximum hourly and continuous load ratings of the components of the sewage disposal facilities and of the maximum hourly and average inflows to the facilities which are anticipated. The description shall show the engineer's estimate of the maximum hour requirements. The description shall compare such requirement estimates with the corresponding capabilities of all the component parts of the proposed waterworks system.

(b) A description of the type of pipe to be used in the sewage collection and transmission system and/or in the water distribution system. This description shall include the type of material from which the pipe is to be fabricated and the type or types of joints to be used.

(9) As exhibit (8)
An estimate(s) in full detail of the cost of construction of the water and/or sewer system shown and described in exhibits (6) and (7) above. This estimate shall be prepared and signed by the registered engineer who prepared and presented exhibits (6) and (7).

(10) As exhibit (9)
A statement of the financing plan by which applicant proposed to fund the construction and/or acquisition of its proposed sewage disposal and/or waterworks system and to secure working capital. Such statement shall show the amount of equity capital applicant expects to have or secure by the issuance of equity securities; the amount of capital it expects to secure by the issuance of notes or bonds; the source and terms of such equity funds and the terms of said notes or bonds and any sums that applicant expects will be voluntarily contributed.

(11) As exhibit (10)
A written statement to the commission from an official of OEPA, stating that OEPA has approved preliminary plans for the proposed sewage disposal system and/or waterworks system and that it would approve final plans upon notification that the commission has granted to the applicant a certificate of public convenience and necessity for the construction and operation of such a system or systems. In the event that approval of final plans is not readily available or cannot by obtained from OEPA, the commission may grant a certificate of public convenience and necessity contingent upon approval by OEPA of final plans.

(12) As exhibit (11)

(a) A proposed construction and installation schedule stated in number of days of expected elapsed time:

(i) Between the issuance of the certificate as applied for and the start of active and continued construction of the facilities; and

(ii) Between the date upon which construction is started and the date of its completion in condition to render the proposed service.

(b) The construction schedule shall contain a statement that the applicant will complete all sewage disposal system facilities and/or water supply system facilities required to adequately serve the entire area for which the certificate of public convenience and necessity is sought and that the completion date will be as stated in paragraph (D)(12)(a)(ii) of this rule, unless work is interrupted by weather or by other conditions beyond applicant's control.

(c) A statement shall be included in the application describing the public convenience to be served by means of granting a certificate of public convenience and necessity to applicant.

(d) One copy of any previously unfiled exhibit offered at the hearing, or subsequent to the hearing, must be made available for the record: one copy for the attorney examiner, one copy for each counsel, and one copy for the attorney general appearing in the case.

HISTORY: Eff. 4-24-87 (1988-87 OMR 1183) 2-3-77

Note: Effective 2-3-77, 4901:1-15-02 contains provisions of former 4901:1-15-01 (prior rule 29.01); see 4901:1-15-05 for provisions of former 4901:1-15-02 (prior rule 29:02).

4901:1-15-03 Public hearing; notice.

[text continues]

(C) Every applicant shall appear in person, or by a corporate officer if applicant is a corporation, at the place and time and on the date set for hearing. Failure of applicant to appear at the hearing is cause for dismissal of the application. The commission may, upon its own motion or upon satisfactory showing of cause, grant a continuance of any hearing. At the hearing on the application for authority or amended authority to operate a sewage disposal and/or waterworks company, the applicant shall show the following:

(1) That there is a present and continuing need by the public in the area encompassed by the applicant for facilities and services of the type which applicant proposes to provide.

(2) That no existing agency, publicly or privately owned or operated, would or could economically and efficiently provide the facilities and services needed by the public in the area which is the subject of the application.

(3) That applicant has in its treasury sufficient unobligated paid in capital funds and has commitments from a responsible financial organization, satisfactory to the commission, which will enable it to secure through the issuance of securities approved by the commission all additional financing necesary [sic] to complete construction of and place into operation its proposed utility system. Sufficient unobligated paid in capital funds is presumed to be that equal to at least forty per cent of the estimated cost of construction of the utility plant. To overcome such presumption, the applicant must show by competent evidence that it otherwise has sufficient unobligated paid in capital funds and satisfactory financial

commitments to complete construction of and place into operation its proposed system.

(4) That, at the rates proposed in applicant's tariff as filed with the application and based upon a pro forma income statement also filed with the application, applicant will have sufficient revenues to enable it to meet its operating and maintenance expenses, to begin establishing a depreciation reserve, to pay all taxes, to establish an adequate reserve for contingencies and to pay interest on any outstanding debt.

(5) That, in the case of water-works systems, the proposed facilities are designed to operate at normal pressure of sixty pounds per square inch and to provide a minimum pressure of twenty-five pounds per square inch at any point in the system under maximum system loading conditions without creating, simultaneously, at any other point on the system a pressure condition in excess of one-hundred and twenty-five pounds per square inch.

(6) That the company's system of mains shall be of adequate size to permit the installation and proper operation of public fire hydrants. (Such public fire hydrants need be installed only if they are paid for by the proper public authority ordering the installation for both the capital cost and the cost of maintaining and operating said hydrants.)

(7) That, if authority to construct and operate a sewage disposal system is the subject, or is one subject, of the application, it shall be shown that the mains and laterals proposed are of adequate size and are to be laid with such flow lines as to permit an expeditious flow from the point of the origin at the customer's premises to the point of treatment or disposal. If land contours are not such as to permit transport of the outflow by gravity, adequate lift stations shall be provided as a part of the applicant's system. If, in lieu of or as an adjunct to such lift stations, force pumps are proposed to be installed to move sewage discharge away from a customer's premises, a full description of the equipment and of the manner and means of its operation shall be included as a part of applicant's evidence.

HISTORY: Eff. 2-3-77

Note: See 4901:1-15-06 for provisions of former 4901:1-15-03 (prior rule 29:03).

APPENDIX C

STATE STATUTES CONCERNING WATER SYSTEM VIABILITY

Sec. 16-262k. Interconnection of public water supply systems to relieve site-specific water shortages. The department of public utility control may require any water company as defined in section 16-1 to connect its public water supply system with that of another water company or municipal utility if it finds that such a connection would be an effective means of relieving site-specific water shortages.

(P.A. 81-358. S. 3.)

Sec. 16-262l. Receivership of water companies for failure to provide adequate service. Personal liability of directors, officers and managers. (a) As used in this section, "water company" includes every corporation, company, association, joint stock association, partnership or person, or lessee thereof, except an association providing water only to its members, owning, leasing, maintaining, operating, managing or controlling any pond, lake, reservoir, stream, well or distributing plant or system employed for the purpose of supplying water to twenty-five or more consumers on a regular basis, provided if any corporation, company, association, joint stock association, partnership or person, or lessee thereof, owns or controls eight per cent of the equity value of more than one such water supply system, the number of consumers shall, for the purpose of this definition, be the total number of consumers of all such systems so controlled by that corporation, company, association, joint stock association, partnership or person, or lessee thereof.

(b) If the department of public utility control determines, after notice and hearing, that any water company is unable or unwilling to provide adequate service to its consumers, the department may petition the superior court for any judicial district wherein the company conducts its business for an order attaching the assets of the company and placing it under the sole control and responsibility of a receiver.

(c) Notwithstanding the provisions of subsection (b) of this section, the department, the municipality served by a water company or an organization representing twenty per cent of the consumers of the company may, upon notice to the company, petition the superior court for an order attaching the assets of the water company and placing it under the sole control and responsibility of a receiver, if (1) the company has failed to supply water to consumers for at least five days during the preceding three months, (2) the department of health services determines that the company has not met the standards adopted under section 25-32 for the quality of public drinking water or (3) the petitioner has reasonable cause to believe the consumers of the company have not received and are unlikely to receive adequate service due to gross mismanagement of the company. Upon the filing of such a petition, the court shall order the company to show cause why such an order of attachment and receivership should not issue ten days from the date of service of the order to show cause upon the company at its last known address.

(d) Any receiver appointed by the court shall file a bond in accordance with section 52-506 unless the court finds it unnecessary. The receiver shall operate the company to preserve its assets and to serve the best interests of its consumers. If the receiver determines that the water company's actions which caused it to be placed under the control and responsibility of the receiver under subsection (b) or (c) of this section is due to misappropriation or wrongful diversion of the assets or income of such company or to other wilful misconduct by any director, officer or manager of the company, the receiver shall file a petition, with the superior court that issued the order of attachment and receivership, for an order that such director, officer or manager be ordered to pay compensatory damages to the company by reason of such misappropriation, diversion or misconduct.

(e) The department of public utility control shall determine the value of the assets of a water company at the time of appointment of a receiver and immediately prior to return of the assets to the owner. The claim of the owner of the company shall be limited to the value determined at the time of the appointment of the receiver. The assets shall be returned to the owner after full restitution has been made to the receiver for the value of any improvements to the system and after payment has been made for any appraisal pursuant to this subsection.

(P.A. 81-358. S. 4; P.A. 82-472. S. 51. 183; P.A. 83-542; P.A. 84-330, S. 7.)

History: P.A. 82-472 made technical correction in Subsec. (a); P.A. 83-542 added Subsec. (c), allowing, in addition to department, municipalities and organizations representing water company consumers to petition superior court for receivership in certain situations and providing for expedited judicial proceedings in such situations and added provisions in Subsec. (d) allowing receiver to petition superior court in certain situations for order that director, officer or manager pay compensatory damages to company; P.A. 84-330 added Subsec. (c) re valuation of assets of water company.

Sec. 16-262m. Construction specifications for water companies. (a) As used in this section, sections 16-262n to 16-262q, inclusive, and section 8-25a, "water company" includes every corporation, company, association, joint stock association, partnership, municipality, other entity or person, or lessee thereof, owning, leasing, maintaining, operating, managing or controlling any pond, lake, reservoir, stream, well or distributing plant or system employed for the purpose of supplying water to not less than fifteen service connections or twenty-five persons not more than two hundred fifty service connections or one thousand persons on a regular basis.

(b) No water company may begin the construction or expansion of a community water supply system on or after October 1, 1984, without having first obtained a certificate of public convenience and necessity for the construction or expansion from the department of public utility control and the department of health services. An application for a certificate shall be on a form prescribed by the department of public utility control in consultation with the department of health services and accompanied by a copy of the water company's construction or expansion plans and a fee of one hundred dollars. The departments shall issue a certificate to an applicant upon determining, to their satisfaction, that (1) no feasible interconnection with an existing system is available to the applicant, (2) the applicant will complete the construction or expansion in accordance with engineering standards established by regulation by the department of public utility control for community water supply systems, (3) the applicant has the financial, managerial and technical resources to operate the proposed water supply system in a reliable and efficient manner and to provide continuous adequate service to consumers served by the system, (4) the proposed construction or expansion will not result in a duplication of water service in the applicable service area and (5) the applicant meets all federal and state standards for community water supply. Any construction or expansion with respect to which a certificate is required shall thereafter by built, maintained and operated in conformity with the certificate and any terms, limitations or conditions contained therein.

(c) The department of public utility control, *in consultation with the department* of health services, shall adopt regulations in accordance with the provisions of chapter 54 to carry out the purposes of this section.

(P.A. 81-427. S. 1. 3; P.A. 84-330. S. 1.)

History: P.A. 84-330 amended Subsec. (a) to apply definition of water company "to sections 16-262n to 16-262q, inclusive, and section 8-25a" to include municipalities in such definition and to expand the definitions by including companies supplying water to not less than fifteen service connections or twenty-five persons nor more than two hundred fifty service connections or one thousand persons, amended Subsec. (b) to require, as a condition for issuing a certificate that determination be made that no feasible interconnection with an existing system is available and that applicant meets all federal and state standards for community water supply and amended Subsecs. (b) and (c) to require departments of public utility control and health services to jointly carry out purposes of the section.

Sec. 16-262n. Failure of water company to comply with orders. Hearing. Whenever any water company fails to comply with an order issued pursuant to section 16-11, 25-32, 25-33, or 25-34 concerning the availability or potability of water or the provision of water at adequate volume and pressure, the department of public utility control and the department of health services may, after notice to public and private water companies, municipal utilities furnishing water service, municipalities or other appropriate governmental agencies in the service area of the water company, conduct a hearing in accordance with the provisions of section 4-177 to determine the actions that may be taken and the expenditures that may be required, including the acquisition of the water company by the most suitable public or private entity, to assure the availability and potability of water and the provision of water at adequate volume and pressure to the persons served by the water company.

(P.A. 84-330. S. 2.)

Sec. 16-262o. *Acquisition of* water company. Rates and charges. (a) The department of public utility control, in consultation with the department of health services, upon a determination that the costs of improvements to and the acquisition of the water company are necessary and reasonable, shall order the acquisition of the water company by the most suitable public or private entity. In making such determination, the department shall consider: (1) The geographical proximity of the acquiring entity to the water company, (2) whether the acquiring entity has the financial, managerial and technical resources to operate the water company in a reliable and efficient manner and to provide continuous, adequate service to the persons served by the company and (3) any other factors the department deems relevant. Such order shall authorize the recovery through rates of all reasonable costs of acquisition and necessary improvements. A public entity acquiring a water company beyond the boundaries of such entity may charge customers served by the acquired company for water service and may, to the extent appropriate, recover through rates all reasonable costs of acquisition and necessary improvements.

(b) Notwithstanding the provisions of any special act, the department of public utility control shall extend the franchise areas of the acquiring water company to the service area of the water company acquired pursuant to this section.

(c) In the case of a public entity acquiring a water company beyond its boundaries, the rates charged the customers of the acquired water company shall be subject to the approval of the department of public utility control, upon petition by such customers.

(P.A. 84-330. S. 3.)

Sec. 16-262p. Improvements by acquiring entity. Any recipient of an order pursuant to section 16-262o shall make the necessary improvements to assure the availability and potability of water and the provision of water at adequate volume and pressure to the persons served by the water company. The water company shall immediately take the steps necessary for the transfer of the company to the acquiring company, municipal water authority, municipality or other public or private entity.

(P.A. 84-330. S. 4.)

Sec. 16-262q. Compensation for acquisition of water company. Compensation for the acquisition of a water company pursuant to section 16-262o shall be determined by the procedures for determining compensation under section 25-42 or by agreement between the parties, provided the department of public utility control in consultation with the department of health services, after a hearing, approves such agreement.

(P.A. 84-330. S. 5.)

NEVADA

Water Controls

445.381 State board of health: Adoption of regulations. [Effective until January 1, 1992.]

The state board of health:

1. Shall adopt regulations establishing procedures for a system of permits to operate water systems which are constructed on or after July 1, 1991.

2. May adopt such other regulations as may be necessary to govern the construction, operation and maintenance of public water systems if those activities affect the quality of water, but the regulations do not supersede any regulation of the public service commission of Nevada.

3. May establish by regulation a system for the issuance of operating permits for suppliers of water and set a reasonable date after which a person shall not operate a public water system constructed before July 1, 1991, without possessing a permit issued by a health authority.

History: 1977, p. 443; 1985, p. 336; 1991, ch. 220, @ 11, p. 403.

445.3851 Systems constructed after June 30, 1991: Assumption of control by local governing body.

1. If the state board of health has found that any of the conditions of a permit to operate such a water system issued pursuant to NRS 445.3841 are being violated and has notified the holder of the permit that he must bring the water system into compliance, but the holder of the permit has failed to comply within a reasonable time after the date of the notice, the local governing body, if requested to do so in writing by the state board of health, may take the following actions independently of any further action by the state board of health:

(a) Give written notice, by certified mail, to the owner of the water system and the owners of the property served by the system that if the violation is not corrected within 30 days after the date of the notice, the local governing body will seek a court order authorizing it to assume control; and

(b) After the 30-day period has expired, if the water system has not been brought into compliance, apply to the district court for an order authorizing the local governing body to assume control of the system and assess the property for the continued operation and maintenance of the system as provided in subsection 5 of NRS 445.3845.

2. If the local governing body determines at any time that immediate action is necessary to protect the public health and welfare, it may assume physical control and operation of a water system without complying with any of the requirements set forth in subsection 1. The local governing body may not maintain control of a

water system pursuant to this subsection for a period greater than 30 days unless it obtains an order from the district court authorizing an extension.
(Added to NRS by 1991, 403)

445.3853 Systems constructed after June 30, 1991: Effect of Provisions. No provision of NRS 445.3841, inclusive, prevents:

1. A local governing body or a health district from imposing its own conditions for approval of the operation of any water system located within its jurisdiction, which may be more stringent than those authorized by NRS 445.3841 to 445.3853, inclusive.

2. A local governing body from requiring the prior approval of a proposed water system by a local committee created for that purpose.

3. A local governing body from converting connections to water systems into connections to water systems provided by a public utility or a municipality or other public entity.

(Added to NRS by 1991, 403)

445.3843 Systems constructed after June 30, 1991: Preliminary request for comments. Before making the finding specified in NRS 445.3851 and before making the determinations specified in NRS 244.3655, 268.4102 and 445.3845, the state board of health shall request comments from the:

1. Public service commission of Nevada;

2. State engineer;

3. Local government within whose jurisdiction the water system is located; and

4. Owner of the water system.

(Added to NRS by 1991, 401)

Article 9. Facilities and Services of Small Water Companies

58:11-59. Failure to comply with order to provide adequate service; finding; notice to capable water utilities or government entities in service area; joint public hearing; determination

Whenever any small water company is found, after notice and public hearing, to have failed to comply, within a specified time, with any order of the Department of Environmental Protection concerning the availability of water, the potability of water and the provision of water at adequate volume and pressure, which the department is authorized to enforce pursuant to Title 58 of the Revised Statutes, the department and the Board of Public Utilities shall, after notice to capable proximate public or private water companies, municipal utilities authorities established pursuant to P.L.1957, c. 183 (C. 40:14B-1 et seq.), municipalities or any other suitable governmental entities wherein the small water company provides service, and the Department of Public Advocate, conduct a joint public hearing to determine: the actions that may be taken and the expenditures that may be required, including acquisition costs, to make all improvements necessary to assure the availability of water. the potability of water and the provision thereof at adequate volume and pressure, including, but not necessarily limited to, the acquisition of the small water company by the most suitable public or private entity. As used in this act, "small water company" means any company, purveyor or entity, other than a governmental agency, that provides water for human consumption and which regularly services less than 1,000 customer connections.

L.1981, c. 347, s1, eff. Dec. 22, 1981.

Title of Act:
An Act concerning improvements to the facilities and services of small water companies and supplementing title 58 of the Revised Statutes. L. 1981, c. 347.

58:11-60 Compensation for acquisition; determination

Compensation for the acquisition of a small water company shall be determined:

(a) By agreement between parties, subject to the approval of the Board of Public Utilities, in consultation with the Department of Environmental Protection, and after the holding of a joint public hearing by the board and the department; or

(b) Through the use of the power of eminent domain.

L.1981, c. 347, s2, eff. Dec. 22, 1981.

58:11-61 Order for acquisition; extension of franchise area of acquiring public or private entity

a. The Department of Environmental Protection and the Board of Public Utilities, upon a determination that the costs of improvements to and the acquisition of the small water company are necessary and reasonable, shall order the acquisition of the small water company by the most suitable public or private entity. This order shall provide for the immediate inclusion in the rates of the acquiring company the anticipated costs of necessary improvements, or, if the determination of acquisition costs has been deferred, as soon as possible thereafter as may be practicable and feasible.

b. The Board of Public Utilities shall extend the franchise area of the acquiring public or private water company to the extent necessary to cover the service area of the small water company taken over pursuant to this act.

L.1981, c. 347, s3, eff. Dec 22, 1981.

58:11-62 Compliance with order

Any water company, municipal utilities authority, municipality or other suitable governmental entity which receives an order pursuant to section 3 of this act shall acquire the small water company and shall make the necessary improvements to assure the availability of water, the potability of the water and the provision of water at adequate volume and pressure. The small water company shall immediately comply with the order and shall facilitate its sale to the water company, municipal utilities authority, municipality or other suitable governmental entity ordered to acquire the small water company.

L.1981, c. 347, s 4, eff. Dec. 22, 1981.

58:11-63 Differential rate for customers of small water company for use or service of acquiring company's system or facilities

Whenever the Department of Environmental Protection and the Board of Public Utilities order the acquisition of a small water company by the most suitable public or private entity pursuant to law, the board may, in its discretion, allow the acquiring company to charge and collect a differential rate from the customers of the small water company for the use or service of the small water company for the use or service of the acquiring company's water supply system or facilities.

L.1981, c. 389, s1.

Historical Note

Section 2 of L.1981, c. 389, approved Jan. 6, 1982, provides:

"This act shall take effect upon enactment of P.L.1981, c. [347] (now pending before the General Assembly as Senate Committee Substitute for Senate Bill No. 1614 [approved Dec. 22, 1981]."

Title of Act:

An Act concerning the acquisition of small water companies and supplementing Title 58 of the Revised Statutes. L.1981,c. 389.

PENNSYLVANIA

House Bill No. 24, Session of 1990

An Act Amending Title 66 (Public Utilities) of the Pennsylvania Consolidated Statutes, further providing for rates.

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 1. Title 66 of the Pennsylvania Consolidated Statutes is amended by adding a section to read:

Sec. 1327. Acquisition of water and sewer utilities.

(a) Acquisition cost greater than depreciated original cost.--If a public utility acquires property from another public utility, a municipal corporation or a person at a cost which is in excess of the original cost of the property when first devoted to the public service less the applicable accrued depreciation, that excess, or any portion thereof found by the commission to be reasonable, may be included in the rate base of the acquiring public utility, provided that the acquiring public utility proves that:

(1) the property is used and useful in providing water or sewer service;

(2) the public utility acquired the property from another public utility, a municipal corporation or a person which had 1,200 or fewer customer connections;

(3) the public utility, municipal corporation or person from which the property was acquired was not, at the time of acquisition, furnishing and maintaining adequate, efficient, safe and reasonable service and facilities, evidence of which shall include, but not be limited to, the following:

(i) violation of statutory or regulatory requirements of the Department of Environmental Resources or the commission concerning the safety, adequacy, efficiency or reasonableness of service and facilities;

(ii) a finding by the commission of inadequate financial, managerial or technical ability of the small water or sewer utility;

(iii) a finding by the commission that there is a present deficiency concerning the availability of water, the palatability of water or the provision of water at adequate volume and pressure; or

(iv) a finding by the commission that the small water or sewer utility, because of necessary improvements to its plant or distribution system, cannot reasonably be expected to furnish and maintain adequate service to its customers in the future at rates equal to or less than those of the acquiring public utility;

(4) reasonable and prudent investments will be made to assure that the customers served by the property will receive adequate, efficient, safe and reasonable service;

(5) the public utility, municipal corporation or person whose property is being acquired is in agreement with the acquisition and the negotiations which led to the acquisition were conducted at arm's length;

(6) the actual purchase price is reasonable;

(7) neither the acquiring nor the selling public utility, municipal corporation or person is an affiliated interest of the other;

(8) the rates charges by the acquiring public utility to its preacquisition customers will not increase "unreasonably" because of the acquisition; and

(9) the excess of the acquisition cost over the depreciated original cost will be added to the rate base to be amortized as an addition to expense over a reasonable period of time with corresponding reductions in the rate base.

(b) Procedure.--The commission, upon application by a public utility, person or corporation which has agreed to acquire property from another public utility, municipal corporation or person, may approve an inclusion in rate base in accordance with subsection (a) prior to the acquisition and prior to a proceeding under this chapter to determine just and reasonable rates if:

(1) the applicant has provided notice of the proposed acquisition and any proposed increase in rates to the customers served by the property to be acquired, in such form and manner as the commission, by regulation, shall require;

(2) the applicant has provided notice to its customers, in such form and manner as the commission, by regulation, shall require, if the proposed acquisition would increase rates to the acquiring public utility's customers;

(3) the applicant has provided notice of the application to the Director of Trial Staff and the Consumer Advocate; and

(4) in addition to any other information required by the commission, the application includes a full description of the proposed acquisition and a plan for reasonable and prudent investments to assure that the customers served by the property to be acquired will receive adequate, efficient, safe and reasonable service.

(c) Hearings.--The commission may hold such hearings on the application as it deems necessary.

(d) Forfeiture.--Notwithstanding section 1309 (relating to rates fixed on complaint; investigation of costs of production), the commission, by regulation, shall provide for a utility to remove the costs of acquisition from its rates and to refund any revenues collected as a result of this section, plus interest, which shall be the average rate of interest specified for residential mortgage lending by the Secretary of Banking in accordance with the act of January 30, 1974 (P.L.13, No.6), referred to as the Loan Interest and Protection Law, during the period or periods for which the commission orders refunds, if the commission, after notice and hearings, determines that the reasonable and prudent investments to be made in accordance with this section have not been completed within a reasonable time.

(e) Acquisition cost lower than depreciated original cost.--If a public utility acquires property from another public utility, a municipal corporation or a person at a cost which is lower than the original cost of the property when first devoted to the public service less the applicable accrued depreciation and the property is used and useful in providing water or sewer service, that difference shall, absent matters of a substantial public interest, be amortized as an addition to income over a reasonable period of time or be passed through to the ratepayers by such other methodology as the commission may direct. Notice of the proposed treatment of an acquisition cost lower than depreciated original cost shall be given to the Director of Trial Staff and the Consumer Advocate.

(f) Reports.--The commission shall annually transmit to the Governor and to the General Assembly and shall make available to the public a report on the acquisition activity under this title. Such report shall include, but not be limited to, the number of small water or sewer public utilities, municipal corporations or persons acquired by public utilities, and the amounts of any rate increases or decreases sought and granted due to the acquisition.

(g) Expiration.--This section shall expire in five years unless extended by statute.

Section 2. This act shall take effect in 60 days.

House Bill No. 36, Session of 1991

An Act Amending Title 66 (Public Utilities) of the Pennsylvania Consolidated Statutes, providing for the commission to order the acquisition of small water and sewer utilities.

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 1. Title 66 of the Pennsylvania Consolidated Statutes is amended by adding a section to read:

S. 529. Power of commission to order acquisition of small water and sewer utilities.

(a) General rule.--The commission may order a capable public utility to acquire a small water or sewer utility if the commission, after notice and an opportunity to be heard, determines:

(1) that the small water or sewer utility is in violation of statutory or regulatory standards, including, but not limited to, the act of June 22, 1937 (P.L.1987, No.394), known as The Clean Streams Law, the act of January 24, 1966 (1965 P.L.1535, No.537), known as the Pennsylvania Sewage Facilities Act, and the act of May 1, 1984 (P.L.206, No.43), known as the Pennsylvania Safe Drinking Water Act, and the regulations adopted thereunder, which affect the safety, adequacy, efficiency or reasonableness of the service provided by the small water or sewer utility;

(2) that the small water or sewer utility has failed to comply, within a reasonable period of time, with any order of the Department of Environmental Resources or the commission concerning the safety, adequacy, efficiency or reasonableness of service, including, but not limited to, the availability of water, the potability of water, the palatability of water or the provision of water at adequate volume and pressure;

(3) that the small water or sewer utility cannot reasonably be expected to furnish and maintain adequate, efficient, safe and reasonable service and facilities in the future;

(4) that alternatives to acquisition have been considered in accordance with subsection (b) and have been determined by the commission to be impractical or not economically feasible;

(5) that the acquiring capable public utility is financially, managerially and technically capable of acquiring and operating the small water or sewer utility in compliance with applicable statutory and regulatory standards; and

(6) that the rates charged by the acquiring capable public utility to its preacquisition customers will not increase unreasonably because of the acquisition.

(b) Alternatives to acquisition.–Before the commission may order the acquisition of a small water or sewer utility in accordance with subsection (a), the commission shall discuss with the small water or sewer utility, and shall give such utility a reasonable opportunity to investigate, alternatives to acquisition, including, but not limited to:

(1) The reorganization of the small water or sewer utility under new management.

(2) The entering of a contract with another public utility or a management or service company to operate the small water or sewer utility.

(3) The appointment of a receiver to assure the provision of adequate, efficient, safe and reasonable service and facilities to the public.

(4) The merger of the small water or sewer utility with one or more other public utilities.

(5) The acquisition of the small water or sewer utility by a municipality, a municipal authority or a cooperative.

(c) Factors to be considered.--In making a determination pursuant to subsection (a), the commission shall consider:

(1) The financial, managerial and technical ability of the small water or sewer utility.

(2) The financial, managerial and technical ability of all proximate public utilities providing the same type of service.

(3) The expenditures which may be necessary to make improvements to the small water or sewer utility to assure compliance with applicable statutory and regulatory standards concerning the adequacy, efficiency, safety or reasonableness of utility service.

(4) The expansion of the franchise area of the acquiring capable public utility so as to include the service area of the small water of sewer utility to be acquired.

(5) The opinion and advice, if any, of the Department of Environmental Resources as to what steps may be necessary to assure compliance with applicable statutory or regulatory standards concerning the adequacy, efficiency, safety or reasonableness of utility service.

(6) Any other matters which may be relevant.

(d) Order of the commission.--Subsequent to the determinations required by subsection (a), the commission shall issue an order for the acquisition of the small water or sewer utility by a capable public utility. Such order shall provide for the extension of the service area of the acquiring capable public utility.

(e) Acquisition price.--The price for the acquisition of the small water or sewer utility shall be determined by agreement between the small water or sewer utility and the acquiring capable public utility, subject to a determination by the commission that the price is reasonable. If the small water or sewer utility and the acquiring capable public utility are unable to agree on the acquisition price or the commission disapproves the acquisition price on which the utilities have agreed, the commission shall issue an order directing the acquiring capable public utility to acquire the small water or sewer utility by following the procedure prescribed for exercising the power of eminent domain pursuant to the act of June 22, 1964 (Sp.Sess., P.L.84, No.6), known as the Eminent Domain Code.

(f) Separate tariffs.--The commission may, in its discretion and for a reasonable period of time after the date of acquisition, allow the acquiring capable public utility to charge and collect rates from the customers of the acquired small water or sewer utility pursuant to a separate tariff.

(g) Appointment of receiver.--The commission may, in its discretion, appoint a receiver to protect the interests of the customers of the small water or sewer utility. Any such appointment shall by order of the commission, which order shall specify the duties and responsibilities of the receiver.

(h) Notice.--The notice required by subsection (a) or any other provision of this section shall be served upon the small water or sewer utility affected, the Office of Consumer Advocate, the Office of Trial Staff, the Department of Environmental Resources, all proximate public utilities providing the same type of service as the small water or sewer utility, all proximate municipalities and municipal authorities providing the same type of service as the small water or sewer utility, and the municipalities served by the small water or sewer utility. The commission shall order the affected small water or sewer utility to provide notice to its customers of the initiation of proceedings under this section in the same manner in which the utility is required to notify its customers of proposed general rate increases.

(i) Burden of proof.--The Law Bureau shall have the burden of establishing a prima facie case that the acquisition of the small water or sewer utility would be in the public interest and in compliance with the provisions of this section. Once the commission determines that a prima facie case has been established:

(1) the small water or sewer utility shall have the burden of proving its ability to render adequate, efficient, safe and reasonable service at just and reasonable rates; and

(2) a proximate public utility providing the same type of service as the small water or sewer utility shall have the opportunity and burden of proving its financial, managerial or technical inability to acquire and operate the small water or sewer utility.

(j) Plan for improvements.--Any capable public utility ordered by the commission to acquire a small water or sewer utility shall, prior to acquisition, submit to the commission for approval a plan, including a timetable, for bringing the small water or sewer utility into compliance with applicable statutory and regulatory standards. The capable public utility shall also provide a copy of the plan to the Department of Environmental Resources and such other State or local agency as the commission may direct. The commission shall give the Department of Environmental Resources adequate opportunity to comment on the plan and shall consider any comments submitted by the department in deciding whether or not to approve the plan. The reasonably and prudently incurred costs of each improvement shall be recoverable in rates only after that improvement becomes used and useful in the public service.

(k) Limitations on liability.--Upon approval by the commission of a plan for improvements submitted pursuant to subsection (j) and the acquisition of a small water or sewer utility by a capable public utility, the acquiring capable public utility shall not be liable for any damages beyond the aggregate amount of $50,000, including a maximum amount of $5,000 per incident, if the cause of those damages is proximately related to identified violations of applicable statutes or regulations by the small water or sewer utility. This subsection shall not apply:

(1) beyond the end of the timetable in the plan for improvements;

(2) whenever the acquiring capable public utility is not in compliance with the plan for improvements; or

(3) if, within 60 days of having received notice of the proposed plan for improvements, the Department of Environmental Resources submitted written objections to the commission and those objections have not subsequently been withdrawn.

(l) Limitations on enforcement actions.–Upon approval by the commission of a plan for improvements submitted pursuant to subsection (j) and the acquisition of a small water or sewer utility by a capable public utility, the acquiring capable public utility shall not be subject to any enforcement actions by State or local agencies which had notice of the plan if the basis of such enforcement action is proximately related to identified violations of applicable statutes of regulations by the small water or sewer utility. This subsection shall not apply:

(1) beyond the end of the timetable in the plan for improvements;

(2) whenever the acquiring capable public utility is not in compliance with the plan for improvements;

(3) if, within 60 days of having received notice of the proposed plan for improvements, the Department of Environmental Resources submitted written objections to the commission and those objections have not subsequently been withdrawn; or

(4) to emergency interim actions of the commission or the Department of Environmental Resources, including, but not limited to, the ordering of boil-water advisories or other water supply warnings, of emergency treatment or of temporary, alternate supplies of water.

(m) Definitions.–As used in this section, the following words and phrases shall have the meanings given to them in this subsection:

"Capable public utility." A public utility which regularly provides the same type of service as the small water utility or the small sewer utility to 4,000 or more customer connections, which is not an affiliated interest of the small water utility or the small sewer utility, and which provides adequate, efficient, safe and reasonable service. A public utility which would otherwise be a capable public utility except for the fact that it has fewer than 4,000 customer connections may elect to be a capable public utility for the purposes of this section regardless of the number of its customer connections and regardless of whether or not it is proximate to the small sewer utility or small water utility to be acquired.

"Small sewer utility." A public utility which regularly provides sewer service to 1,200 or fewer customer connections.

"Small water utility." A public utility which regularly provides water service to 1,200 or fewer customer connections.

Section 2. This act shall take effect in 60 days.

TEXAS

Subchapter G. Certificates of Convenience and Necessity

Sec. 13.242. Certificate Required

(a) Unless otherwise specified, a utility or water supply or sewer service corporation many not in any way render retail water or sewer utility service directly or indirectly to the public without first having obtained from the commission a certificate that the present or future public convenience and necessity require or will require that installation, operation, or extension, and except as otherwise provided by this subchapter, a retail public utility may no furnish, make available, render, or extend retail water or sewer service to any area to which retail water or sewer utility service is being lawfully furnished by another retail public utility without first having obtained a certificate of public convenience and necessity that includes the area in which the consuming facility is located.

[text continues]

Sec. 13.246. Notice and Hearing; Issuance or Refusal; Factors Considered

[text continues]

(c) Certificates of convenience and necessity shall be granted on a nondiscriminatory basis after consideration by the commission of the adequacy of service currently provided to the requested area, the need for additional service in the requested area, the effect of the granting of a certificate on the recipient of the certificate and on any retail public utility of the same kind already serving the proximate area, the ability of the applicant to provide adequate service, the feasibility of obtaining service from an adjacent retail public utility, the financial stability of the applicant, including, if applicable, the adequacy of the applicant's debt-equity ratio, environmental integrity, and the probable improvement of service or lowering of cost to consumers in that area resulting from the granting of the certificate.

Sec. 13.251. Sale, Assignment, or Lease of Certificate

Except as provided in Section 13.255 or this code, a utility or a water supply or sewer service corporation may no sell, assign, or lease a certificate or public convenience and necessity or any right obtained under a certificate unless the commission has determined that the purchaser, assignee or lessee is capable or rendering adequate and continuous service to every consumer within the certified area, after considering the factors under Section 13.246(c) of this code. The sale, assignment or lease shall be on the conditions prescribed by the commission.

[text continues]

Sec. 13.253. Improvements in Service; Interconnecting Service

After notice and hearing , the commission may:

(1) order any retail public utility that is required by law to possess a certificate of public convenience and necessity to provide specified improvements in its service in a defined area if service in that area is inadequate or is substantially inferior to service in a comparable area and it is reasonable to require the retail public utility to provide the improved service;
(2) order two or more public utilities or water supply or sewer service corporations to establish specified facilities for the interconnecting service; or
(3) issue an emergency order, with or without a hearing, under Section 13.401 of this code.

Sec. 13.254. Revocation or Amendment of Certificate.

(a) The commission at any time after notice and hearing may revoke or amend any certificate of public convenience and necessity with the written consent of the certificate holder or if it finds that the certificate holder has never provided, is not longer providing, or has failed to provide continuous and adequate service in the area, or part of the area, covered by the certificate.

Sec. 13.255. Single Certification in Incorporated or Annexed Areas

[text continues]

(j) This section shall apply only in a case where:
(1) the retail public utility that is authorized to serve in the certificated area that is annexed or incorporated by the municipality is a nonprofit water supply or sewer service corporation; or
(2) the retail public utility that is authorized to serve in the certificated area that is annexed or incorporated by the municipality is a retail public utility, other than a nonprofit water supply or sewer service corporation, and whose service area is located entirely within the boundaries of a municipality with a population of 1.7 million or more according to the most recent federal census.

(k) The following conditions apply when a municipality or franchised utility makes an application to acquire the service area of facilities of a retail public utility described in Subsection (j)(2):
(1) the commission or court must determine that the service provided by the retail public utility is substandard or its rates are unreasonable in view of the reasonable expenses of the utility;
(2) if the municipality abandons its application, the court or the commission is authorized to award to the retail public utility its reasonable expense related to the proceeding hereunder, including attorney fees; and
(3) unless otherwise agreed by the retail public utility, the municipality must take the entire utility property of the retail public utility in a proceeding hereunder.

Sec. 13.301. Report of Sale, Merger, Etc.; Investigation; Disallowance of Transaction

(a) A utility or a water supply or sewer service corporation shall notify the commission and give pubic notice unless public notice is waived by the executive director for good cause shown at least 120 days before the effective date of any sale, acquisition, lease, or rental of any water or sewer system required by law to possess a certificate of public convenience and necessity or if any merger or consolidation with such a utility or water supply or sewer service corporation.

[text continues]

Sec. 13.411. Action to Enjoin or Require Compliance

If it appears to the commission that any retail public utility or any other person or corporation is engaged in or is about to engage in any act in violation of this chapter or of any order or rule of the commission entered or adopted under this chapter or that any retail public utility or any other person or corporation is failing to comply with this chapter or with any rule or order, the attorney general on request of the commission, in addition to any other remedies provided in this chapter, shall bring an action in a court of competent jurisdiction in the name of and on behalf of the commission against the retail public utility o other person or corporation to enjoin the commencement of continuation of any act or to require compliance with this chapter or the rule or order.

Sec. 13.412. Receivership

(a) At the request of the commission, the attorney general shall bring suit for the appointment of a receiver to collect the assets and carry on the business of a water or sewer utility that has abandoned operation of its facilities or violates a final order of the commission or allows any property owned or controlled by it to be used in violation of a final order of the commission.

[text continues]

Sec. 13.4131. Supervision of Certain Utilities

(a) The commission, after providing to the utility notice and an opportunity for a hearing, may place a utility under supervision for gross or continuing mismanagement, gross or continuing noncompliance with this chapter or commission rules, or noncompliance with commission orders.

(b) While supervising a utility, the commission may require the utility to abide by conditions and requirements prescribed by the commission, including:

(1) management requirements;

(2) additional reporting requirements;

(3) restrictions on hiring, salary or benefit increases, capital investment, borrowing, stock issuance or dividend declarations, and liquidation of assets; and

(4) a requirement that the utility place the utility's funds into an account in a financial institution approved by the commission and use of those funds shall be restricted to reasonable and necessary utility expenses.

(c) While supervising a utility, the commission may require that the utility obtain commission approval before taking any action that may be restricted under Subsection (b) of this section. Any action or transaction which occurs without commission approval may be voided by the commission.

Sec. 13.4132. Operation of Utility That Discontinues Operation or is Referred for Appointment of Receiver

(a) The commission, after providing to the utility notice and an opportunity for a hearing, may authorize a willing person to temporarily manage and operate a utility that has discontinued or abandoned operations or the provision of services or is being referred to the attorney general for the appointment of a receiver under Section 13.412 of this code.

(b) The commission may appoint a person under this section by emergency order, and notice of the action is adequate if the notice is mailed or hand-known address of the utility's headquarters.

(c) A person appointed under this section has the powers and duties necessary to ensure the continued operation of the utility and the provision of continuous and adequate services to customers, including the power and duty to:

(1) read meters;
(2) bill for utility services;
(3) collect revenues;
(4) disburse funds; and
(5) request rate increase;

(d) This section does not affect the authority of the commission to pursue an enforcement claim against a utility or an affiliated interest.

Amendments and additions of Acts 1991, 72nd Leg., ch. 678, Sec. 13, eff. Sept. 1, 1991.

WASHINGTON

Chapter 133, Substitute Senate Bill No. 6447, 1990, Failing Public Water Systems

AN ACT Relating to failing public water systems; amending RCW 36.94.140, 43.70.190, 43.70.200, 43.155.070, 43.155.065, 70.199A.040, and 70.05.070; adding a new section to chapter 8.25 RCW; adding a new section to chapter 43.70 RCW; creating new sections; prescribing penalties; and declaring an emergency.

Be it enacted by the Legislature of the State of Washington:

Sec. 1. The legislature finds the best interests of the citizens of the state are served if:

(1) Customers served by public water systems are assured of an adequate quantity and quality of water supply at reasonable rates;

(2) There is improved coordination between state agencies engaged in water system planning and public health regulation and local governments responsible for land use regulation and public health and safety;

(3) Public water systems in violation of health and safety standards adopted under RCW 43.20.050 remain in operation and continue providing water service providing that public health is not compromised, assuming a suitable replacement purveyor is found and deficiencies are corrected in an expeditious manner consistent with public health and safety; and

(4) The state address, in a systematic and comprehensive fashion, new operating requirements which will be imposed on public water systems under the federal Safe Drinking Water Act.

Sec. 2. Section 14, chapter 72, Laws of 1967 as amended by section 2, chapter 188, Laws of 1975 1st ex. sess. and RCW 36.94.140 are each amended to read as follows:

Every county, in the operation of a system of sewerage and/or water, shall have full jurisdiction and authority to manage, regulate and control it and to fix, alter, regulate and control the rates and charges for the service to those to whom such county service is available, and to levy charges for connection to such system. The rates for availability of service and connection charges so charged must be uniform for the same class of customers or service.

In classifying customers served, service furnished or made available by such system of sewerage and/or water, or the connection charges, the board may consider any or all of the following factors:

(1) The difference in cost of service to the various customers within or without the area;

(2) The difference in cost of maintenance, operation, repair and replacement of the various parts of the systems;

(3) The different character of the service furnished various customers;

(4) The quantity and quality of the sewage and/or water delivered and the time of its delivery;

(5) Capital contributions made to the system or systems, including, but not limited to, assessments; (and)

(6) The cost of acquiring the system or portions of the system in making system improvements necessary for the public health and safety; and

(7) Any other matters which present a reasonable difference as a ground for distinction.

Such rates shall produce revenues sufficient to take care of the costs of maintenance and operation, revenue bond and warrant interest and principal amortization requirements, and all other charges necessary for the efficient and proper operation of the system.

Sec. 3. Section 5, chapter 102, Laws of 1967 ex. sess. as last amended by section 258, chapter 9, Laws of 1989 1st ex. sess. and RCW 43.70.190 are each amended to read as follows:

The secretary of health or local health officer may bring an action to enjoin a violation or the threatened violation of any of the provisions of the public health laws of this state or any rules or regulation made by the state board of health or the department of health pursuant to said laws, or may bring any legal proceeding authorized by law, including but not limited to the special proceedings authorized in Title 7 RCW, in the superior court in the county in which such violation occurs or is about to occur, or in the superior court of Thurston county. Upon the filing of any action, the court may, upon a showing of an immediate and serious danger to residents constituting an emergency, issue a temporary injunctive order ex parte.

Sec 4. A new section is added to chapter 43.70 RCW to read as follows:

(1) In any action brought by the secretary of health or by a local health officer pursuant to chapter 7.60 RCW to place a public water system in receivership, the petition shall include the names of one or more suitable candidates for receiver who have consented to assume operation of the water system. The department shall maintain a list of interested and qualified individuals, municipal entities, special purpose district, and investor-owned water companies with experience in the provision of water service and a history of satisfactory operation of a water system. If there is no other person willing and able to be named as receiver, the court shall appoint the county in which the water system is located as receiver. The county may designate a county agency to operate the system, or it may contract with another individual or public water system to provide management for the system. If the county is appointed as receiver, the secretary of health and the county health officer

shall provide regulatory oversight for the agency or other person responsible for managing the water system.

(2) In any petition for receivership under subsection (1) of this section, the department shall recommend that the court grant to the receiver full authority to act in the best interests of the customers served by the public water system. The receiver shall assess the capability, in conjunction with the department and local government, for the system to operate in compliance with health and safety standards, and shall report to the court its recommendations for the system's future operation, including the formation of a water district or other public entity, or ownership by another existing water system capable or providing service.

(3) If a petition for receivership and verifying affidavit executed by an appropriate departmental official allege an immediate and serious danger to residents constituting an emergency, the court shall set the matter for hearing within three days and may appoint a temporary receiver ex parte upon the strength of such petition and affidavit pending a full evidentiary hearing, which shall be held within fourteen days after receipt of the petition.

(4) A bond, if any is imposed upon a receiver, shall be minimal and shall reasonably relate to the level of operating revenue generated by the system. Any receiver appointed pursuant to this section shall not be held personally liable for any good faith, reasonable effort to assume possession of, and to operate, the system in compliance with the court's orders.

(5) The court shall authorize the receiver to impose reasonable assessments on a water system's customers to recover expenditures for improvements necessary for the public health and safety.

Sec. 5. Section 6, chapter 102, Laws of 1967 ex. sess. as last amended by section 259, chapter 9, Laws of 1989 1st ex. sess. and RCW 43.70.200 are each amended to read as follows:

Upon the request of a local health officer, the secretary of health is hereby authorized and empowered to take legal action to enforce the public health laws and rules and regulations of the state board of health or local rules and regulations within the jurisdiction served by the local health department, and may institute any civil legal proceeding authorized by the laws of the state of Washington, including a proceeding under Title 7 RCW.

Sec. 6. Section 12, chapter 446, Laws of 1985 as last amended by section 3, chapter 93, Laws of 1988 and RCW 43.155.070 are each amended to read as follows:

(1) To qualify for loans or pledges under this chapter the board must determine that a local government meets all of the following conditions:

(a) The city or county must be imposing a tax under chapter 82.46 RCW at a rate of at least one-quarter of one percent;

(b) The local government must have developed a long-term plan for financing public works needs; and

(c) The local government must be using all local revenue sources which are reasonably available for funding public works, taking into consideration local employment and economic factors.

(2) The board shall develop a priority process works projects as provided in this section. The intent of the priority process is to maximize the value of public works projects accomplished with assistance under this chapter. The board shall attempt to assure a geographical balance in assigning priorities to projects. The board shall consider at least the following factors in assigning a priority to a project:

(a) Whether the local government receiving assistance has experienced severe fiscal distress resulting from natural disaster or emergency public works needs;

(b) Whether the project is critical in nature and would affect the health and safety of a great number of citizens;

(c) The cost of the project compared to the size of the local government and amount of loan money available;

(d) The number of communities served by or funding the project;

(e) Whether the project is located in an area of high unemployment, compared to the average state unemployment; (and)

(f) Whether the project is the acquisition, expansion, improvement, or renovation by a local government of a public water system that is in violation of health and safety standards, including the cost of extending existing service to such a system, and

(g) Other criteria that the board considers advisable.

(3) Existing debt or financial obligations of local governments shall not be refinanced under this chapter. Each local government applicant shall provide documentation of attempts to secure additional local or other sources of funding for each public works project for which financial assistance is sought under this chapter.

(4) Before November 1 of each year, the board shall develop and submit to the chairs of the ways and means committees of the senate and house of representatives a description of the emergency loans made under RCW 43.155.065 during the preceding fiscal year and a prioritized list of projects which are recommended for funding by the legislature, including one copy to the staff of each of the committees. The list shall include, but not be limited to, a description of each project and recommended financing, the terms and conditions of the loan or financial guarantee, the local government jurisdiction and unemployment rate, demonstration of the jurisdiction's critical need for the project and documentation of local funds being used to finance

the public works project. The list shall also include measures of fiscal capacity for each jurisdiction recommended for financial assistance, compared to authorized limits and state averages, including local government sales taxes; real estate excise taxes; property taxes; and charges for or taxes or sewerage, water, garbage, and other utilities.

(5) The board shall not sign contracts or otherwise financially obligate funds from the public works assistance account before the legislature has appropriated funds for a specific list of public works projects. The legislature may remove projects from the list recommended by the board. The legislature shall not change the order of the priorities recommended for funding by the board.

(6) Subsections (4) and (5) of this section do not apply to loans made for emergency public works projects under RCW 43.155.065.

Sec. 7. Section 1. chapter 93, Laws of 1988 and RCW 43.155.065 are each amended to read as follows:

The board may make low-interest or interest-free loans to local governments for emergency public works projects. Emergency public works projects shall include the construction, repair, reconstruction, replacement, rehabilitation, or improvement of a public water system that is in violation of health and safety standards and is being operated by a local government on a temporary basis. The loans may be used to help fund all or part of an emergency public works project less any reimbursement from any of the following sources: (1) Federal disaster or emergency funds, including funds from the federal emergency management agency; (2) state disaster or emergency funds; (3) insurance settlements; or (4) litigation. Emergency loans may be made only from those funds specifically appropriated from the public works assistance account for such purpose by the legislature. The amount appropriated from the public works assistance account for emergency loan purposes shall not exceed five percent of the total amount appropriated from this account in any biennium.

Sec. 8, Section 4, chapter 271, Laws of 1986 as amended by section 135, chapter 175, Laws of 1989 and RCW 70.119A.040 are each amended to read as follows:

(1) In addition to or as an alternative to any other penalty provided by law, every person who commits any of the acts or omissions in RCW 70.119A.030 shall be subjected to a penalty in an amount of not less than five hundred dollars. The maximum penalty shall be not more that five thousand dollars per day for every such violation. Every such violation shall be a separate and distinct offense. The amount of fine shall reflect the health significance of the violation and the previous record of compliance on the part of the public water supplier. In case of continuing violation, every day's continuance shall be a separate and distinct violation. Every person who, through an act of commission or omission, procures, aids, or abets in the violation shall be considered to have violated the provisions of this section and shall be subject to the penalty provided in this section.

(2) The penalty provided for in this section shall be imposed by a notice in writing to the person against whom the civil fine is assessed and shall describe the violation. The notice shall be personally served in the manner of service of a summons in a civil action or in a manner that shows proof of receipt. A penalty imposed by this section is due twenty-eight days after receipt of notice unless application for remission or mitigation is made as provided in subsection (3) of this section or unless application for an adjudicative proceeding is filed as provided in subsection (4) of this section.

(3) Within fourteen days after the notice is received, the person incurring the penalty may apply in writing to the department for the remission or mitigation of such penalty. Upon receipt of the application, the department may remit or mitigate the penalty upon whatever terms the department in its discretion deems proper, giving consideration to the degree of hazard associated with the violation, provided the department deems such remission or mitigation to be in the best interests of carrying out the purposes of this chapter. The department shall not mitigate the fines below the minimum penalty prescribed in subsection (1) of this section. The department shall have the authority to ascertain the facts regarding all such applications in such reasonable manner as it may deem proper. When an application for remission on mitigation is made, a penalty incurred under this section is due twenty-eight days after receipt of the notice setting forth the disposition of the application, unless an application for an adjudicative proceeding to contest the disposition is filed as provided in subsection (4) of this section.

(4) Within twenty-eight days after notice is received, the person incurring the penalty may file an application for an adjudicative proceeding and may pursue subsequent review as provided in chapter 34.05 RCW and applicable rules of the department or board of health.

(5) A penalty imposed by a final order after an adjudicative proceeding is due upon service of the final order.

(6) The attorney general may bring an action in the name of the department in the superior court of Thurston county, or of any county in which such violator may do business, to collect a penalty.

(7) All penalties imposed under this section shall be payable to the state treasury and credited to the general fund.

Sec. 9. A new section is added to chapter 8.25 RCW to read as follows:

Consistent with standard appraisal practices, the valuation of a public water system as defined in RCW 70.229A.020 shall reflect the cost of system improvements necessary to comply with health and safety rules of the state board of health and applicable regulations developed under chapter 43.20, 43.20A, or 70.116 RCW.

Sec. 10. Section 12, chapter 51, Laws of 1967 ex. sess. as last amended by section 7, chapter 25, Laws of 1984 and RCW 70.05.070 are each amended to read as follows:

The local health officer, acting under the direction of the local board of health or under direction of the administrative officer appointed under RCW 70.05.040, if any, shall:

(1) Enforce the public health statutes of the state, rules and regulations of the state board of health and the secretary of social and health services, and all local health rules, regulations and ordinances within his or her jurisdiction including imposition of penalties authorized under RCW 70.119A.030 and filing of actions authorized by RCW 43.70.190;

(2) Take such action as is necessary to maintain health and sanitation supervision over the territory within his or her jurisdiction;

(3) Control and prevent the spread of any dangerous, contagious or infectious diseases that may occur within his or her jurisdiction;

(4) Inform the public as to the causes, nature, and prevention of disease and disability and the preservation, promotion and improvement of health within his or her jurisdiction;

(5) Prevent, control or abate nuisances which are detrimental to the public health;

(6) Attend all conferences called by the secretary of social and health services or his or her authorized representative;

(7) Collect such fees as are established by the state board of health or the local board of health for the issuance or renewal of licenses or permits or such other fees as may be authorized by law or by the rules and regulations of the state board of health((.));

(8) Inspect, as necessary, expansion or modification of existing public water systems, and the construction of new public water systems, to assure that the expansion, modification, or construction conforms to system design and plans;

(9) Take such measures as he or she deems necessary in order to promote the public health, to participate in the establishment of health educational or training activities, and to authorize the attendance of employees of the local health department or individuals engaged in community health programs related to or part of the programs of the local health department.

Sec. 11. The department shall prepare a report for the legislature no later than December 1, 1990, with regard to the problems of small water systems and proposed solutions. Such a report shall be prepared in consultation with the utilities and transportation commission, the department of community development, department of ecology, public works assistance board, and associations of cities, counties, public and private utilities, water districts, local health directors, and other interested groups. The report shall address, at a minimum, the following topics, with alternative approaches or solutions:

(1) The number and locations of existing public systems that do not meet public health and safety standards;

(2) Costs associated with state enforcement of new federal standards under the 1986 amendments to the Safe Drinking Water Act, including expenses and potential financing mechanisms for the operating costs of receivers of water systems when the system revenue is otherwise inadequate to cover the costs;

(3) Available financing for capital improvements for both publicly owned and privately owned water systems;

(4) Legal and regulatory barriers to improved delivery of safe and reliable drinking water supplies to the state's residents and in particular regulating and enforcement overlap between the department and the utilities and transportation commission;

(5) The effect of failing or inadequate water supplies on the ability of an owner to sell, or a buyer to obtain financing to buy, residential real estate in this state;

(6) Staffing levels for both state and local agencies responsible for enforcing the state's drinking water laws, including mechanisms for funding such staff;

(7) Revisions to requirements relating to certification of operators for public water systems, including the utilization state-wide of a system of satellite operators; and

(8) Such other topics as are significant and relevant.

Sec. 12. If any provision of this act or its application to any person or circumstance is held invalid, the remainder of the act of the application of the provision to other persons or circumstances is not affected.

Sec. 13. This act is necessary for the immediate preservation of the public peace, health, or safety, or support of the state government and its existing public institutions, and shall take effect immediately.

Passed the Senate March 3, 1990.
Passed the House March 1, 1990.
Approved by the Governor March 21, 1990.
Filed in Office of Secretary of State March 21, 1990.

APPENDIX D

REGIONALIZATION OPTIONS: DEFINITIONS, ADVANTAGES, AND DISADVANTAGES

Informal Agreement	<u>Definition</u> A voluntary cooperative arrangement between water systems or between a water system and another service entity to provide a needed function or share a common facility. <u>Advantages</u> Easy to create or implement Adjustable to duration of need Forerunner of more binding relationship Easy to terminate <u>Disadvantages</u> Not legally enforceable Easy to terminate No formal continuity from administrator to administrator
Regional Council of Local Officials	<u>Definition</u> A nonbinding forum for identifying problems common to a given area (usually one affected by more than one jurisdiction) and promoting agreement on mutual courses of action. <u>Advantages</u> Easy to create Provides centralized planning and coordination Provides a forum for community and individual input to decisionmaking No restrictions on local autonomy or policy control <u>Disadvantages</u> Decisions not legally enforceable No power to raise funds Relation to other governmental units is strictly advisory
Basic Service Contract	<u>Definition</u> A legal agreement between water systems or between a water system and a water service company to provide a service. <u>Advantages</u> Easy to create No restrictions on local autonomy or policy control No governmental reorganization Adjustable to meet changing service needs and demands Realization of unit cost savings via larger quantity purchases (economies of scale) Able to provide specialized services not otherwise available No voter approval required

Basic Service Contract (continued)	<u>Disadvantages</u> Easy to terminate; back to original status if terminated Temporary (possibly) Too expensive (sometimes) May provide only part of needed services
Joint Service Agreement	<u>Definition</u> The sharing or exchange of activities among two or more water systems or other service entities, typically more complex than a basic service contract. <u>Advantages</u> Easy to create Realization of unit cost savings via larger quantity purchases (economies of scale) Minimal disruption of existing organizational and administrative structures More permanent than basic service contracts More uniform coordination and administration of services More efficient use of personnel, equipment, and facilities Able to provide specialized services not otherwise available Elimination of duplication of facilities Increase in overall efficiency of service No voter approval required <u>Disadvantages</u> Impact on local autonomy and policy control More difficult to terminate than basic service contracts Benefits to outside jurisdictions that do not compensate participants Sometimes difficult to distribute costs equally Difficult to compute and equally distribute some overhead costs Difficult for participants to provide service themselves if the agreement fails
Satellite Management	<u>Definition</u> The process by which a larger or central water utility assists a small system by (1) providing varying levels of technical, operational, or managerial assistance on a contract basis, (2) providing wholesale treated water with or without additional services, or (3) assuming ownership, operation, and maintenance responsibility when the small system is physically separate from another source of supply. A system is not considered a satellite when it is physically connected to and owned by the larger utility.

Satellite Management (continued)	<u>Advantages</u> Improved economy of scale for satellites Expands revenue base of parent utility Provides needed resources to satellites Satellite can retain local autonomy Improved water quality management of satellite Improves use of public funds when satellites are publicly owned <u>Disadvantages</u> Less independence for satellite Fear of satellite being absorbed by the larger utility
Annexation	<u>Definition</u> Occurs when a water system extends its service area to include neighboring territory through a change in service boundaries or a change in corporate limits. <u>Advantages</u> Immediate increase in service area population Makes use of the existing water supplier's infrastructure Provision of service to areas outside jurisdictional boundaries Annexed area acquires same rights and obligations as rest of service area Realization of economies of scale Power of eminent domain Applicable to municipal services in addition to water supply <u>Disadvantages</u> Not easy to implement Susceptible to public opposition from those not wishing to be annexed Voter approval may be required Can be politically motivated Not applicable to noncontiguous areas Capital expense required to service new customers
Association/ Nonprofit Water Supply Corporation	<u>Definition</u> Usually created under the authority of a state charter, these entities commonly exist in unincorporated and largely rural areas. <u>Advantages</u> Easy to create Authorized to acquire water sources and construct and operate a water distribution system Power of eminent domain Authorized to issue bonds secured by assets and revenues Not-for-profit operation Authorized to seek federal financing

Association/ Nonprofit Water Supply Corporation (continued)	<u>Disadvantages</u> No power to tax Not authorized to issue general obligation bonds Limited power in relation to other governmental units
Local Special-Purpose District	<u>Definition</u> Generally units of local government that provide a specific service to a defined geographic area. <u>Advantages</u> Often provides the only method to provide a much needed service Power of eminent domain Authorized to levy special assessments Can match service areas with service needs More efficient than local government Greater financial flexibility than local government Less restrictive than local government on cooperative agreements Convenient and inexpensive way to provide service in local areas <u>Disadvantages</u> General obligation bonds not backed by full faith and credit of parent government Restricted to revenue bonds, which can be repaid only by user revenues Powers limited directly to those required to provide service Quasi-governmental entity Susceptible to public opposition because of its permanence
Areawide Special District/ Authority	<u>Definition</u> Similar but distinguished from local special districts by the larger service area affected, the wider range of service provided (such as water and sewerage service), and a higher degree of autonomy. <u>Advantages</u> No state-imposed debt ceilings Timely access to major sources of capital Higher salaries to attract more technical and skilled personnel A "quasi-business" Provision of service to areas that cross jurisdictional boundaries Realization of economies of scale <u>Disadvantages</u> Potential lack of accessibility and accountability Activities uncoordinated with those of other local governments Potentially less cost-effective

Water Districts

Definition

Utilities formed by county officials, most often upon petition of citizens, under state enabling laws to provide one or more water systems in a designated geographical or franchise area.

Advantages

Eligible for public grants and loans
Can issue tax-free securities
Has potential economy of size
Facilitates takeover or contract services with publicly owned noncommunity systems and small privately owned systems
Can be a major tool in controlling proliferation of small systems
Right of eminent domain
A decided tax advantage
Retains local autonomy

Disadvantages

Can be subject to politics
Can be another small system unless there is a good local planning effort
Competes with private enterprise
Distance factors may eliminate ability to serve needy systems

County Utilities

Definition

Utilities owned and operated by the county (or township) commissions or by county public works departments (excluding water districts).

Advantages

Provides central management
Can enable economy of scale
Easy to establish
Not easy to terminate
Decided tax advantages
Facilitates takeover of troubled systems
Eligible for public grants and loans

Disadvantages

Can be subject to politics
Competes with private enterprise
Requires enabling law

State Utilities

Definition

Utilities owned and operated by an agency of state government or a stat agent that operates and maintains water utilities on a contractual basis.

State Utilities (continued)	<u>Advantages</u> Savings through centralized purchasing, management, consultation, planning and technical assistance State owned systems provide a substantial base Bonding advantages of the state Broad geographical base Close ties with regulatory agencies A trained network of skilled operators Allows cost sharing of major equipment Facilities takeover of state owned utilities Provides means to operate abandoned or troubled small systems Can be a tool in controlling proliferation of small systems <u>Disadvantages</u> Slow response (bureaucracy) Perceived as "The State" Competes with private contractors Can be subject to politics Requires enabling law Geographical distribution may eliminate ability to serve some needy systems

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Source: Adapted from SMC Martin, Inc., *Regionalization Options for Small Water Systems* (Washington, DC: Environmental Protection Agency, 1983) and Robert G. McCall, *Institutional Alternatives for Small Water Systems* (Denver, CO: American Water Works Association Research Foundation, 1986).

APPENDIX E

DUN & BRADSTREET BUSINESS RATIOS

I. Solvency

Quick Ratio is computed by dividing cash plus accounts receivable by total current liabilities. Current liabilities are all the liabilities that fall due within one year. This ratio reveals the protection afforded short-term creditors in cash or near-cash assets. It shows the number of dollars of liquid assets available to cover each dollar of current debt. Any time this ratio is as much as 1 to 1 (1.0) the business is said to be in a liquid condition. The larger the ratio the greater the liquidity.

Current Ratio. Total current assets are divided by total current liabilities. Current assets include cash, accounts and notes receivable (less reserves for bad debts), advances on inventories, merchandise inventories, and marketable securities. This ratio measures the degree to which current assets cover current liabilities. The higher the ratio the more assurance exists that the retirement of current liabilities can be made. The current ratio measures the margin of safety available to cover any possible shrinkage in the value of current assets. Normally a ratio of 2 to 1 (2.0) or better is considered good.

Current Liabilities to Net Worth is derived by dividing current liabilities by net worth. This contrasts the funds that creditors temporarily are risking with the funds permanently invested by the owners. The smaller the net worth and the larger the liabilities, the less security for the creditors. Care should be exercised when selling any firm with current liabilities exceeding two-thirds (66.6 percent) of net worth.

Current Liabilities to Inventory. Dividing current liabilities by inventory yields another indication of the extent to which the business relies on funds from disposal of unsold inventories to meet its debts. This ratio combines with Net Sales to inventory to indicate how management controls inventory. It is possible to have decreasing liquidity while maintaining consistent sales-to-inventory ratios. Large increases in sales with corresponding increases in inventory levels can cause an inappropriate rise in current liabilities if growth isn't made wisely.

Total Liabilities to Net Worth. Obtained by dividing total current plus long-term and deferred liabilities by net worth. The effect of long-term (funded) debt on a business can be determined by comparing this ratio with Current Liabilities to Net Worth. The difference will pinpoint the relative size of long-term debt, which, if sizable, can burden a firm with substantial interest charges. In general, total liabilities shouldn't exceed net worth (100 percent) since in such cases creditors have more at stake than owners.

Fixed Assets to Net Worth. Fixed assets are divided by net worth. The proportion of net worth that consists of fixed assets will vary greatly from industry to industry but generally a smaller proportion is desirable. A high ratio is unfavorable because heavy investment in fixed assets indicates that either the concern has a low net working capital and is overtrading or has utilized large funded debt to supplement working capital. Also, the larger the fixed assets, the bigger the annual depreciation charge that must be deducted from the income statement. Normally, fixed assets above 75 percent of net worth indicate possible over-investment and should be examined with care.

II. Efficiency

Collection Period. Accounts receivable are divided by sales and then multiplied by 365 days to obtain this figure. The quality of the receivables of a company can be determined by this relationship when compared with selling terms and industry norms. In some industries where credit sales are not the normal way of doing business, the percentage of cash sales should be taken into consideration. Generally, where most sales are for credit, any collection period more than one-third over normal selling terms (40.0 for 30-day terms) is indicative of some slow-turning receivables. When comparing the collection period of one concern with that of another, allowances should be made for possible variations in selling terms.

Net Sales to Inventory. Obtained by dividing annual net sales by inventory. Inventory control is a prime management objective since poor controls allow inventory to become costly to store, obsolete or insufficient to meet demands. The sales-to-inventory relationship is a guide to the rapidity at which merchandise is being moved and the effect on the flow of funds into the business. This ratio varies widely between different lines of business and a company's figure is only meaningful when compared with industry norms. Individual figures that are outside either the upper or lower quartiles for a given industry should be examined with care. Although low figures are usually the biggest problem, as they indicate excessively high inventories, extremely high turnovers might reflect insufficient merchandise to meet customer demand and result in lost sales.

Assets to Sales is calculated by dividing total assets by annual net sales. This ratio ties in sales and the total investment that is used to generate those sales. While figures vary greatly from industry to industry, by comparing a company's ratio with industry norms it can be determined whether a firm is overtrading (handling an excessive volume of sales in relation to investment) or undertrading (not generating sufficient sales to warrant the assets invested). Abnormally low percentages (above the upper quartile) can indicate overtrading which may lead to financial difficulties if not corrected. Extremely high percentages (below the lower quartile) can be the result of overly conservative or poor sales management, indicating a more aggressive sales policy may need to be followed.

Sales to Net Working Capital. Net sales are divided by net working capital. (Net working capital is current assets minus current liabilities.) This relationship indicates whether a company is overtrading or conversely carrying more liquid assets than needed for its volume. Each industry can vary substantially and it is necessary to compare a company with its peers to see if it is either overtrading on its available funds or being overly conservative. Companies with substantial sales gains often reach a level where their working capital becomes strained. Even if they maintain an adequate total investment for the volume being generated (Assets to Sales), that investment may be so centered in fixed assets or other noncurrent items that it will be difficult to continue meeting all current obligations without additional investment or reducing sales.

Accounts Payable to Sales. Computed by dividing accounts payable by annual net sales. This ratio measures how the company is paying its suppliers in relation to the volume being transacted. An increasing percentage, or one larger than the industry norm, indicates the firm may be using suppliers to help finance operations. This ratio is especially important to short-term creditors since a high percentage could indicate potential problems in paying vendors.

III. Profitability

Return on Sales (Profit Margin) is obtained by dividing net profit after taxes by annual net sales. This reveals the profits earned per dollar of sales and therefore measures the efficiency of the operation. Return must be adequate for the firm to be able to achieve satisfactory profits for its owners. This ratio is an indicator of the firm's ability to withstand adverse conditions such as falling prices, rising costs and declining sales.

Return on Assets. Net profit after taxes divided by total assets. This ratio is the key indicator of profitability for a firm. It matches operating profits with the assets available to earn a return. Companies efficiently using their assets will have a relatively high return while less well-run businesses will be relatively low.

Return on Net Worth (Return on Equity) is obtained by dividing net profit after tax by net worth. This ratio is used to analyze the ability of the firm's management to realize an adequate return on the capital invested by the owners of the firm. Tendency is to look increasingly to this ratio as a final criterion of profitability. Generally, a relationship of at least 10 percent is regarded as a desirable objective for providing dividends plus funds for future growth.

Source: Dun & Bradstreet Credit Services, *Industry Norms & Key Business Ratios, One Year Edition 1988-89* (New York: Dun & Bradstreet, 1989), v-vi.

APPENDIX F

COMPONENTS OF A BUSINESS PLAN FOR SMALL WATER SYSTEMS

1. Assess compliance status with Pennsylvania Department of Environmental Resources (PADER) Design Standards, Part II, Community System Design Standards, PADER Public Water Supply Manual

2. Define Service Area(s)
   - current
   - projected
     - short-term (5-10 years)
     - long-term (30-40 years)
     - ultimate

3. Estimate Demands
   - population and population served
   - per capita
   - unaccounted-for
   - conservation impacts
   - historical record analysis
   - projections
     - short-term
     - long-term
     - ultimate
   - average daily demands
   - maximum daily demands
   - special considerations

4. Document Existing Facilities
   - location
   - capacity
   - permits
   - condition and service life

5. Document Adjoining Systems
   - service areas
   - primary facilities
   - system capabilities
   - hydraulic profile

6. Source of Supply
   - establish drought yield
   - compare with demands
   - identify source capacity needs
   - identify new source options
   - evaluate yield, treatment, etc. requirements
   - evaluate source and potential sources

7. Water Resource Protection Programs
   - wellhead protection
   - watershed protection

8. **Treatment**
   - cover existing and potential sources
   - evaluate raw and finished water quality
   - assess current treatment requirements and SDWA compliance
   - monitor for unregulated contaminants to forecast future treatment needs
   - assess vulnerability to other contaminants, not detected in monitoring
   - evaluate treatment adequacy
   - evaluate improvement alternatives
   - identify treatment options
   - waste disposal systems

9. **Transmission**
   - piping
   - pumping
   - special requirements

10. **Distribution Storage**
    - operating storage
    - emergency reserve
    - fire service
    - service level hydraulics

11. **Distribution Network**
    - service pressures
    - sizing
    - looping
    - condition

12. **Metering System**
    - master metering
    - customer metering

13. **Operation Facilities**
    - office facilities and equipment
    - garage and equipment storage
    - materials storage
    - SCADA system
    - chemical storage

14. **Property Requirements**
    - lands
    - easements
    - records

15. **Quality Testing Capabilities**
    - field testing
    - laboratory
        - in-house
        - outside services

16. **Emergency Service Capabilities**
    - failure evaluations
    - auxiliary power

17. **Alternative Facility Projects**
    - alternative system makeups
    - estimation of full costs of alternatives (perhaps using expanded version of PAWATER cost model)
    - life cycle cost analyses
    - other evaluations
    - selection of optimum capital improvements program

18. **Capital Improvements Program**

    - documentation
    - implementation
    - monitoring
    - regular updating

1. **Plan of Organization and Control**
   - chain of command
   - clear duties, responsibilities, etc.

2. **Staffing and Personnel Management**
   - size adequacy
   - qualifications, experience, certification, etc.

3. **Policies and Standards**
   - general rules and regulations
   - main extension policies
   - standard specifications

4. **Budgeting, Planning and Rate Analysis**
   - capital improvements planning and capital budgeting
   - annual budget process
   - rate review and adequacy of operating revenues

5. **Accounting Practices and Tracking Systems**
   - accounting conventions and standards
   - departmental and special project tracking systems
   - budget performance tracking and reporting
   - fixed asset recordkeeping
   - taxes and other filings

6. **Expenditure Controls and Purchasing Procedures**

7. **Billing and Collection**

8. **Records Management**
   - mapping
   - facility records
   - customer records
   - O&M records
   - operations reporting
   - regulatory reporting
   - priority records (permits, deeds, etc.)
   - records security

9. **Regulatory Compliance Program**
   - quantity
   - quality
   - other

10. **Emergency and Drought Response Plans**
    - emergency protocols
    - system interconnections and interactions
    - drought contingency plan

11. **External Relations**
    - customers and the general public
    - media
    - local and state government agencies

12. **Engineering, Legal and Other Outside Services**

1. **Detailed Facility Descriptions**
   - listings
   - drawings
   - specifications
   - performance data
   - facility and/or equipment manuals

2. **Start-up and Shut-down Procedures**
   - detailed instructions
   - potential alarm conditions
   - records and logs

3. **Normal Operating Procedures**
   - personnel responsibilities, interactions, etc.
   - communications data
   - monitoring and recordkeeping (SCADA, other)
   - records and logs
   - system performance (pressure monitoring, etc.)

4. **Facility and Equipment Inspections**
   - regular/routine scheduling
   - periodic/special scheduling
   - check lists
   - records and logs
   - by internal staff
   - with outside assistance

5. **Planned Maintenance and Replacement Programs**
   - routine/preventive activities
   - potential special activities
   - scheduling
   - material requirements
   - equipment requirements
   - staffing requirements
   - detailed instructions

6. **Emergency and Drought Operating Procedures**

7. **Water Quality Monitoring**
   - identify quality monitoring program
     - regulatory imposed
     - supplemental
   - procedures (parameters, locations, frequency, etc.)
   - responsibilities (staff, labs)
   - reporting
   - response procedures
   - sanitary surveys

8. **Unaccounted-for Water Program**
   - leakage detection program
   - meter accuracy program

9. **Cross-Connection Control (Backflow Prevention) Program**
   - defined policies
   - policy enforcement

10. **Operations Records and Reporting**
    - comprehensive information
    - information recovery (filing)
    - operations records
    - management reporting
    - timeliness of reporting systems
    - complaint/response records
    - failure records and analysis
    - staff responsibilities
    - regulatory reporting

11. **Operations Staffing and Training**
    - training and certification
    - continuing education

12. **Safety Programs**
    - manual or documentation
    - policies, procedures, etc.
    - training (routine or special)
    - hazardous material emphasis
    - SARA Title III obligations
    - accident records

Financial Plan

1. **Establishing financial planning models to provide framework for assessing water system costs, past and projected, and to generate customer rate estimates; suggest utilization of PAWATER for facility cost estimates and AWWA "Financial Planning Model for Water Utilities" or equivalent for capital budgeting and rate analysis.**

2. **Document historical cost experiences**
   - capital cost records
   - debt related costs
   - operating expenses - comprehensive
     - operations
     - maintenance
     - administrative

3. **Establish Financing Parameters**
   - current and projected
   - customer mix
   - consumption and peaking factors
   - financial control parameters (interest rates, borrowing terms, etc.)

4. **Capital Program Costs**
   - documents CIP from facilities plan
   - analyze funding requirements
   - identify revenue requirements

5. **Operating and Maintenance Costs**
   - analyze historical costs
   - projected costs

6. **Establish Total Revenue Requirements**
   - following accepted practices (e.g., AWWA M35 Manual)
   - merge capital and O&M annual payments
   - provide for adequate reserves

7. **Analyze and Establish Rates and Charges**
   - follow accepted practices (e.g., AWWA M1 and M26 Manuals)
   - evaluate alternatives
   - test at alternative growth rates
   - devise adequate rates

8. **Monitor Performance**
   - process to monitor financial performance
   - budget comparisons and provisions for adjustments

Source: Wade Miller Associates, Inc., *State Initiatives to Address Non-Viable Small Water Systems in Pennsylvania* (Arlington, VA: Wade Miller Associates, Inc., 1991), appendix C.

APPENDIX G

APPLICATION OF THE ALTMAN AND PLATT AND PLATT MODELS TO WATER UTILITIES

The Altman Model

Because of structural and operating differences, the Altman's Z-Score model is not expected to perform well for water companies. The 1968 model has five independent predictor variables and assumes the following mathematical form:

$$Z = 1.2*X1 + 1.4*X2 + 3.3*X3 + .6*X4 + 1.0*X5.$$

The independent predictor variables X1 to X5 are defined as follows:

X1 = working capital/total assets
X2 = retained earnings/total assets
X3 = operating income/total assets
X4 = market value of equity/book value of debt
X5 = sales/total assets.

When the Altman model is applied to individual firms the Z Score predicts whether the firm will file for bankruptcy within one year (indeed, Altman's sample of firms actually did file for Chapter 7 or 11 bankruptcy protection). The predictive accuracy for two or three years previous to filing is less accurate. The accuracy of most models falls off considerably two, three, or four years prior to bankruptcy. The Z Score can be interpreted as follows:

$\leq$ 1.81	Bankruptcy very probable within one year
$\geq$ 2.99	Bankruptcy very unlikely within one year
1.81 to 2.99	Uncertain area
$\geq$ 3.00	Strong
$\geq$ 4.00	Very strong

Typically the Z Score is estimated annually for client firms. Deterioration in the Z Score is apparent as it approaches the critical level of 1.81. The model is not universally accurate and needs to be applied on a regular basis to get a clear view of a firm's bankruptcy possibility under a variety of economic circumstances. The applications shown below are for one time period only, which tends to lessen the usefulness of the model.

The Z-Score model first was applied to a number of nonregulated firms that were known to be financially distressed in 1988-89 (based on bankruptcy or near bankruptcy). Second, it was applied to five water utilities for 1989 whose stock is actively traded on major stock exchanges--the well known water utilities. Finally, it was tested on some water companies that are less well known, identified from the 1989 NAWC annual financial report for member companies. The latter firms are divided into the five "best" and the five "worst" in 1989 based on their return on equity (net income/total common equity). Since the market value of stocks is not available for all firms it was necessary to use the alternate form of Altman's model, referred to as the Z' Score model. This form was designed for small firms or privately held firms whose market prices are difficult to find. All of the results are shown in table G-1.

The Z scores for the financially weak and nonregulated companies (Group A) are higher than for the three groups of water utilities and, except for Financial News Network, are close to the "uncertain" range of the Altman scale. Strong companies generally would have very high Z scores of 4.0 or higher and they tend to deteriorate each year if the company's financial position weakens.[1]

Of the water utilities the weakest ones (Group C) show very low Z' scores compared with the last two groups of strong water companies even though all of the water utilities in Groups B, C, and D are predicted to enter bankruptcy according the Altman scale. The model, though lacking, indicates that weak water companies can be predicted to have lower Z or Z' scores as the theory suggests. That the model predicts bankruptcy for all water companies is due to structural and operating differences between regulated water utilities and other nonutility firms. Different independent predictor variables could be used for water companies if a water-industry-specific model was desired. The increasing acceptance of such models is indicated by Altman's claim that about thirty-six major clients have subscribed to his service.

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[1] Altman, *Corporate Financial Distress.*

TABLE G-1
APPLICATION OF ALTMAN'S Z-SCORE MODEL

Group A: Five Financially Weak Nonregulated Firms (a)

1.	Goody Products	Z = 3.21	ROE = -7.6% (b)
2.	Child World	Z = 3.23	ROE = 2.8
3.	Financial News Network(c)	Z = 6.66	ROE = 11.4
4.	Tonka	Z = 1.80	ROE = 3.0
5.	Ames Department Stores(d)	Z = 2.40	ROE = 7.2

Group B: Five Strongest and Widely Traded Water Utilities Based on ROE(b)

1.	The York Water Company	Z = .657	ROE = 12.70%
2.	California Water Service	Z = 1.380	ROE = 12.50
3.	Connecticut Water Service	Z = .752	ROE = 11.30
4.	Indianapolis Water (IWC)	Z = .591	ROE = 10.80
5.	American Water Works	Z = 4.450	ROE = 9.90

Group C: Five Strongest NAWC Water Utilities Based on ROE(b)

1.	Suburban Water Supply	Z' = 1.260	ROE = 18.34%
2.	Wilmington Suburban (GN)	Z' = .510	ROE = 18.16
3.	Bloomsburg Water Company (GN)	Z' = .948	ROE = 17.85
4.	Metropolitan	Z' = 1.042	ROE = 16.80
5.	Wakefield	Z' = .610	ROE = 15.84

Group D: Five Weakest NAWC Water Utilities Based on ROE(b)

1.	Rolling Oaks	Z' = .234	ROE = -34.65%
2.	West Lafayette	Z' = .725	ROE = -14.93
3.	Lackland City	Z' = .795	ROE = -12.84
4.	Gordon's Corners	Z' = .308	ROE = -11.54
5.	Unionville	Z' = .187	ROE = -2.37

Source: Annual reports and *NAWC Annual Financial Reports*. Data are for 1989.

(a) Selected on the basis of bankruptcy or near bankruptcy.
(b) ROE indicates return on equity.
(c) Filed for bankruptcy in March 1991.
(d) Filed for bankruptcy in April 1990.

The Platt and Platt Model

Another recently published bankruptcy prediction model is the one developed by Platt and Platt.[2] It is commercially available also and is different from earlier models in that while it uses similar predictor ratios it uses the individual firm's ratio relative to the same ratio for the industry. Thus the firm's financial position is looked at vis-a-vis the industry. This was done mostly because it minimizes data instability over time and incorporates the effect of industry factors on individual companies both being serious problems with other models.[3] That is why it is referred to as an industry-relative model.

The Platt and Platt model has the following form:

$$P_i = 1/[\ 1 + \exp. -(B_0 + B_1X_{i1} + B_2X_{i2} + \ldots B_nX_{in})],$$

where: P_i = probability of failure of the ith firm, and
X_{ij} = jth industry-relative ratio of the ith firm.

The final estimated form of the Platt and Platt model includes the following independent predictor variables:

X1 = sales growth (percent change)
X2 = cash flow/sales
X3 = net fixes assets/total assets
X4 = total debt/total assets
X5 = current liabilities/total debt
X6 = industry output change * X2
X7 = industry output change * X4.

An illustration of the model appears in table G-2. It is difficult to replicate the model without access to a complete industry data base and the estimated coefficients. Clients must contract to use the model and obtain the necessary information. The estimated probability formula for the sample company is:

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[2] Platt and Platt, "Development of a Class of Stable Predictive Variables: The Case of Bankruptcy Prediction," 31-51.

[3] Ibid.

Probability = exp.**[(2*P) - 10]
= 2.718**(-1.51) - 10
= 2.718 **(-13.02)
= 0.0000022.

The estimated failure probability of 0.0000022 is infinitely small for the illustrated company. If the firm was financially distressed the probability value would approach 1. When failure is unlikely it approaches zero as the illustration shows. The ratios used in the Platt and Platt model are similar to those of Pinches, Hamer, Zavgren, Altman, and others.

The Platt and Platt model was tested on two water companies taken from the 1989 NAWC *Operating and Financial Data*. The two companies include the water utility with the lowest return on equity (ROE) in 1989, Rolling Oaks (ROE= -34.64 percent); and the water utility with the highest return on equity in 1989, Suburban Water Supply Company (ROE= 18.34 percent). The Platt and Platt probabilities of failure for both companies were in the range of .0000089, which is extremely low even though one of utilities is in serious financial distress.

TABLE G-2

APPLICATION OF THE PLATT AND PLATT INDUSTRY-RELATIVE MODEL

Step 1: Calculate Ratio Values

$$\text{Ratio 1} = \frac{\text{Sales (new) - Sales (old)}}{\text{Sales (old)}} = \frac{100}{1900} = 0.052$$

$$\text{Ratio 2} \quad \frac{\text{Cash flow}}{\text{Sales}} = \frac{75 + 100}{2000} = 0.088$$

$$\text{Ratio 3} = \frac{\text{Net fixed assets}}{\text{Total assets}} = \frac{125}{575} = 0.217$$

$$\text{Ratio 4} = \frac{\text{Total debt}}{\text{Total assets}} = \frac{150 + 275}{575} = 0.739$$

$$\text{Ratio 5} = \frac{\text{Short-term debt}}{\text{Total debt}} = \frac{150}{150 + 275} = 0.353$$

$$\text{Ratio 6} = \frac{\text{Industry output (old) - Industry output (new)}}{\text{Industry output (new)}} = 0.027$$

Step 2: Calculate Industry-Relative Ratio Values

$$\text{Ratio 1} = \frac{\text{Company ratio}}{\text{Industry ratio}} = \frac{.052}{.027} = 1.93$$

$$\text{Ratio 2} = \frac{\text{Company ratio}}{\text{Industry ratio}} = \frac{.088}{.088} = 1.00$$

$$\text{Ratio 3} = \frac{\text{Company ratio}}{\text{Industry ratio}} = \frac{.217}{.434} = 0.50$$

$$\text{Ratio 4} = \frac{\text{Company ratio}}{\text{Industry ratio}} = \frac{.739}{.600} = 1.23$$

$$\text{Ratio 5} = \frac{\text{Company ratio}}{\text{Industry ratio}} = \frac{.353}{.400} = 0.88$$

TABLE G-2 (continued)

Step 3: Enter Industry-Relative Ratios into Formula

$$
\begin{aligned}
P &= -3.98 + (-.007 * \text{Ratio } 1) \\
&\quad - (1.23 * \text{Ratio } 2) \\
&\quad + (0.43 * \text{Ratio } 3) \\
&\quad + (2.36 * \text{Ratio } 4) \\
&\quad + (0.58 * \text{Ratio } 5) \\
&\quad + (-6.11 * \text{Ratio } 6 * \text{Ratio } 2) \\
&\quad + (7.61 * \text{Ratio } 6 * \text{Ratio } 4)
\end{aligned}
$$

$$
\begin{aligned}
P &= -3.98 + (-.007 * 1.93) \\
&\quad - (1.23 * 1.00) \\
&\quad + (0.43 * 0.50) \\
&\quad + (2.36 * 1.23) \\
&\quad + (0.58 * 0.88) \\
&\quad + (-6.11 * 0.027 * 1.00) \\
&\quad + (7.61 * 0.027 * 1.23)
\end{aligned}
$$

$$P = -1.51$$

Step 4: Solve for Probability of Bankruptcy

$$
\begin{aligned}
\text{Probability} &= \text{EXP}^{**} [(2 * P) - 10] \\
&= 2.718^{**} [(2 * -1.51) - 10] \\
&= 2.718^{**} [-13.02]
\end{aligned}
$$

$$\text{Probability} = 0.0000022$$

Source: Used with permission of Dr. Harlan D. Platt.

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