U.S. Water and Wastewater: Are There Lessons for Developing Countries?

By

Sanford V. Berg

Director, Public Utility Research Center, University of Florida

Give us the serenity to accept those things we cannot change;

Give us the courage to change those things that can be changed; and

Give us the wisdom to know the difference.

Reinhold Niebuhr (who did not advocate change for the sake of change)

If we know what is possible and what is impossible, we have identified the boundaries for action. Thus, experiences in other countries can help us understand how particular societies have addressed problems. We hope to learn from the mistakes of others, so that we do not repeat past errors.

As one reviews U.S. institutions responsible for water and wastewater regulation, one thing stands out: the complexity of the arrangements for addressing four distinct types of regulation—resource regulation, economic regulation, public health regulation, and environmental regulation. Environmental regulation can be incorporated into the first and third categories, but the four issues underscore the interdependencies that arise when policies by one agency (for example, one that promotes economic development) come into conflict with another (one whose mission is to promote sustainable use of water resources).

Decision-makers who have tried to deal with complexity in different regions of the U.S. and at different times in its history have created a variety of institutions and laws to address problems as they arose. The result is a mix of international, national, interstate, state, regional, and municipal institutions that attempt to address water issues. These organizations often work at cross-purposes, with "power" becoming the item of concern. When rival government bureaucracies seek power, the result is more likely to be delay and paralysis than building the capacity to manage complicated water problems.

Nearly four decades ago, my colleague Jerry Milliman identified problems with urban water supply.[1] He considered issues related to water resources, water pricing, and incentives for operating efficiencies and investments. Today, water is identified as one of the sectors requiring significant national investment. The infrastructure has a huge "deficit" according to many observers. Furthermore, the tangle of subsidies and under-pricing of water continues as a national scandal. While surface and groundwater is

[1] J. W. Milliman, "Policy Horizons for Future Urban Water Supply," *Land Economics*, 1963, pp. 109-132.

cleaner than four decades ago, environmental problems remain. Thus, we should not hold the U.S. as a "model".

Rather, the experience of the U.S. illustrates the *political economy of regulation*. Regulations tend to confer concentrated benefits to a few groups while distributing the costs across the larger population. Those coalitions benefiting from current institutional (and pricing) arrangements understand clearly the implications of existing rules and procedures. Those who bear the costs are spread across the population (and over time), and these costs are small on a per-capita basis. The result is that we often find water projects whose costs exceed their benefits—since the political momentum is too great. One conclusion that might be drawn from this tendency is that some institutions need to be advocates for efficiency and fairness. Information and citizen education can be an antiseptic for treating the political diseases associated with the exercise of power by special interest groups.

On the basis of experience in the U.S. and around the world, water regulations tend to give priority to current consumers, leaving future citizens with the problem of cleaning up after the current generation. The long-term nature of water and wastewater investment encourages political leaders to avoid addressing fundamental issues of efficiency and fairness since the up-front costs are large and the benefits accrue to future voters. If a wealthy nation like the U.S. mismanages its water resources, what hope is there for other countries desperate for capital investment and clean water?

The same type of present-future trade-off faces developing countries that are trying to expand access to water—without making current beneficiaries pay the opportunity cost of service. One hope is that those funding water investments will take greater care in ensuring that the entire "system" is, indeed, sustainable. Past funds from national and international development agencies have benefited some consumers, but it is unclear as to why these beneficiaries should continue to be subsidized while others remain without water service.

Economic regulators can have a significant impact on public perceptions regarding water "problems". One role of sector regulators is to educate citizens regarding the long-term consequences of inappropriate policies. A second role is to serve as a bridge between other government agencies concerned with water issues. Improved water sector performance is a significant achievement. The sector represents a unique opportunity for a government that purports to help its citizens. The Appendix to this short paper provides a much more detailed outline of the institutional features of the U.S. water/wastewater industry. Those are "trees"; here, the focus is on the "forest".

Resource Regulation

Resource regulation relates to water rights and licensing, surface water protection and groundwater extraction. An understanding of hydrology and watersheds is crucial for efficient development of water resources. We have learned that water cannot be treated

like a perfectly renewable resource. Regional planning groups and water conservation boards often play a role in local resource allocation. The fundamental point is that few agencies take explicit account of the opportunity costs associated with using water this year instead of some future year. Allocating water resources over time is seldom handled through a price system that reflects the true opportunity cost of current usage levels. Political structures seem to prefer implicit allocation of water rights (for irrigation, hydroelectric power, recreation, navigation, and consumption.) Local water resource managers prefer conversation programs to pricing water at levels that rations it across uses. Local managers do not press for changes in usage patterns that harm current stakeholders.

The lack of confidence in the use of the price system partly reflects the interests of those grandfathered into current allocations. These groups often do not want values of current subsidies revealed by auction mechanisms or tradable water rights. In general, the result is the under-pricing of the raw resource. Groundwater is drawn down and surface water is allocated to low-valued uses (where that use benefits the politically powerful). The true opportunity cost of water is ignored, which leads to higher future costs. Economic regulators are generally happy to under-price the resource, since this reduces political pressures. In addition, in many cases residential use represents a small proportion of water use compared with agriculture and industry.

Economic Regulation

Economic regulation refers to traditional regulation of water utilities, including rate design (tariff levels and structure), quality of service (pressure, avoidance of leakage), and contract compliance.[2] However, since most water service is provided by municipal utilities, the role of state regulators is somewhat limited. Thus, the City Commission or some oversight group is assigned the responsibility for ensuring that water is priced appropriately and that the system is expanded to meet housing development in the geographic area.

Comparisons of water rates across U.S. cities (1998) reveal dramatic differences:

City	Price/1,000 gallons
Memphis TN	0.60
Seattle WA (winter)	0.78
Dallas TX	0.99
Chattanooga TN	1.43
Atlanta GA	1.72
Los Angeles CA	1.89
Phoenix AZ (June-Sept.)	2.16

[2] See Leonard S. Hyman, *The Water Business: Understanding the Water Supply and Wastewater Industry*, Public Utilities Reports, Inc. Vienna, Virginia, 1998.

The range of prices reflects hydrological conditions, the historical evolution of water system capacity, different municipal approaches to cost recovery (including returns on investments), and different philosophies regarding the role of water in attracting business or expanding city boundaries.

Still, the price of water in the U.S. is lower than in most European nations. Consider comparative water prices levels in 1999 for some developed countries.[3]

Country	Water Price (US$/m^3)
Germany	1.81
Denmark	1.61
Netherlands	1.19
France	1.17
United Kingdom	1.15
Spain	0.54
United States	0.50
Canada	0.41

Prices for a set of Asian cities (in 1997) suggest dramatic under-pricing of water:

City	Water Price (US$/m^3)
Mandalay	.81
Singapore	.39
Bangkok	.16
Lahore	.05
Karachi	.14
Jakarta	.16
Dhaka	.08
Delhi	.01
Manila	.03

The latter set of numbers (also from Whittington) includes cities with different coverage rates and water quality (in terms of continuity, pressure, and presence of organic material).

[3] From a presentation by Dale Whittington at the PURC/World Bank International Training Program on Utility Regulation and Strategy, 2001.

What are we to make of these comparisons? First, we ought to want to know more about these other dimensions of water. In addition, it would help to know water charges as a share of income. Whittington provides this information for Denmark (.8%), France (1.1%) Germany (1.0%), Greece (0.4%), Spain (0.4%), and the UK (1.2%). Of course, domestic water use differs greatly across countries.[4] Wastewater rates vary as well.

Rate structure comparisons in the U.S. illustrate the diverse philosophies of different oversight agencies. The American Water Works Association reports a 1996 survey of 827 U.S. utilities:

Rate Structure	Percent
Uniform Rate	.39
Declining Block	.33
Increasing Block	.22
Flat Rate	.04
Seasonal	.02

These rate levels and rate structures have some links to accounting costs, but one would be hard-pressed to argue that there is a "typical" rate design or costing methodology. For example, the Raftelis Environmental Consulting Group's 1996 rate survey describes the approach used in Los Angeles: a two-block seasonal increasing rate structure, according to lot size, temperature zone, and household size. In addition, the associated cost of capital varies across state jurisdictions, partly because of accounting treatments. Contributions-in-aid-of-construction is one issue that warrants attention, as does the use of embedded capital costs that differ from forward-looking capital costs.

Turning from water, let us consider sewerage services. The U.S. is under-pricing wastewater services at present. During the 1970s and 1980s, the Environmental Protection Agency had a Wastewater Treatment Construction Grants Program that was very successful in reducing the pollutants discharged by sewage treatment plants. More than $60 billion in grants subsidized local entities and kept prices low. In the future, either further national subsidies will be required (so taxpayers foot the bill) or prices will have to be raised to cover the $16 billion per year capital shortfall. Grants have been phased out and replaced by loans, but local municipalities now have to pay interest. Wastewater or sewer bills are about $200 per household per year.[5] According to Stallworth, the 83 million households with sewer connections would need to have their bills doubled to fund the estimated future investment shortfall in wastewater infrastructure.[6]

[4] A similar comparison across Latin America and the Caribbean would be most informative.
[5] Rafetelis Environmental Consulting Group, Inc. *Rafetelis Environmental Consulting Group 1998 Water and Wastewater Rate Survey.* Charlotte, N.C., 1998.
[6] Holly Stallworth, *Conservation Pricing of Water and Wastewater*, 2000.

Stallworth (p.2) summarized the 1996 Raftelis report, outlining some broad patterns for the U.S.:

- Larger systems appear to have more recently enacted rate structures.
- Larger systems get their water predominately from surface sources.
- Regional differences are apparent in rate structure choices, reflecting in part supply availability.
- The variety of rate structures is growing.
- Nonresidential wastewater charges often incorporate surcharges for strength characteristics.
- Utilities are using stormwater pricing more frequently.
- There are many different connection and system development charges.
- Outside rates for customers beyond municipal boundaries are becoming more common.
- A difference exists in pricing practices between public and private systems.

One might conclude that water pricing has been primarily a local issue. In states with privately owned systems, the multi-sector regulator will set prices based on traditional rate-of-return regulation.

Public Health Regulation

Public health regulation focuses on the water quality received by users. World Health Organization standards serve as one set of quality targets. Customer education regarding the importance of sanitation is another element of this phase of regulation. Certainly water quality standards dictated by public health authorities have implications for the price of delivered water and for wastewater services.

One issue for the economic regulator is how to contribute to the public debate over incremental improvements in water quality. Political leaders can trumpet high objectives, but a realistic schedule is seldom part of the public debate. Standards that are beyond the financial capacity of its citizenry can actually discourage sensible investments to improve quality if monitoring agencies use a pass-fail approach to quality regulation.

There is a further trade-off: government development funds used for water quality improvements are not available for other valued projects, including the expansion of water distribution systems or protection of watersheds. There is no simple “solution”; the problem of scarcity must be managed so that the most cost-effective programs are implemented first. Clearly, if current utilities are poorly managed and inadequately maintained, then improvements in performance would free up resources to create benefits such as better water quality or expanded access to clean water. Thus, the economic regulator serves a crucial role in reducing utility operating inefficiencies and improving project selection for investments.

Environmental Regulation

Environmental regulation can refer to ensuring the quality of the raw resource (limiting pollution run-off from agriculture, for example). It also refers to oversight of wastewater treatment and disposal procedures. In the United States, significant investments have been made to upgrade treatment facilities. As noted earlier, these projects have received subsidies from the federal government; that is to say, from taxpayers.

Thus, environmental regulations have required significant investments in the U.S. In the UK, Ofwat took the initiative when the timing for implementing European Union standards became a political issue. The Director General of Ofwat provided ministries, Parliament, and the general public information on the implications for price. The resulting national debate led to a slower phasing in of regulations than desired by the environmental agencies. The U.S. has not gone through the same kind of national debate on who should pay for what over what period of time.

Just as in the case of public health regulation, the economic regulator potentially plays a central role in environmental regulation. Environmental agencies implement the policies established by ministries and legislatures. If the economic regulator does not play a pro-active role in ensuring cost-effective environmental programs, the impact on water bills can be significant and can even bring the sustainability of the regulatory system into question.

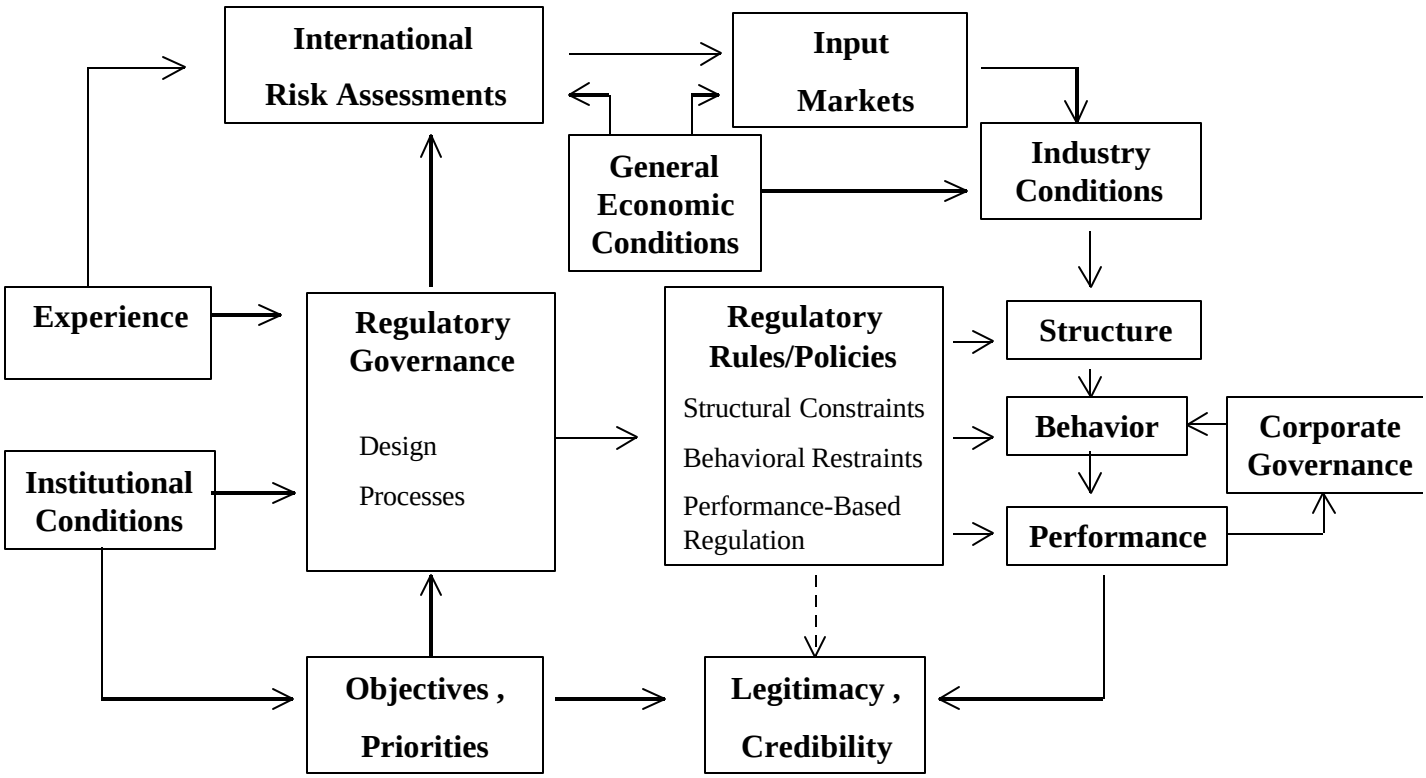
Legitimacy: Promoting Improved Performance[7]

Figure 1 below depicts the forces influencing regulatory practice and sector performance. Although it may be overly simplistic, it outlines the circular dynamics of the larger decision-making environment in which government policymakers, regulatory commissions, investors, and firms operate and interact. Regulators must monitor these factors (described in more detail in Berg and Holt, 2002) in order to take advantage of potential allies and new information that can strengthen new institutions. Regulators must be familiar with underlying production technologies (and opportunities for cost containment) as well as international perceptions regarding country risk. For example, a Standard and Poor's report on Infrastructure Finance[8] illustrates how financial institutions are beginning to evaluate the regulatory climate in different nations. Decisions being made today will form the basis of future regulatory rankings.

[7] The last section of this paper draws on material presented at the Australia Competition and Consumer Commission Conference, Sydney, July 25-26, 2002.

[8] Anthony Flintoff, "Utility Price Regulation: A Credit Perspective," *Infrastructure Finance: Commentary*, Standard and Poor's, 1999. The focus is primarily on Australia, but the elements investors view as important are universal.

Figure 1. Factors Affecting Sector Performance and Regulatory Credibility



Rather than going through the figure in detail, let us focus on how lessons from the U.S. can help regulators achieve greater legitimacy (from the standpoint of citizens) and credibility (in terms of domestic and international investors and domestic institutions). Government objectives and priorities represent the starting point for reviewing performance. The objectives represent a social consensus regarding what is possible and what is desirable. If interagency disputes and regulatory rulings result in a lack of local trust in the regulatory process, the consequences are significant for the long term. The system will not be sustainable without legitimacy. In particular, government regulation of government corporations can be contentious since the latter may argue that they already have adequate oversight.

Utility behavior is determined by regulatory policies governing price caps, reliability mandates, service standards, and network modernization requirements. Service to rural regions is likely to be more costly than service supplied to more densely populated areas. Regulators can set targets for reliability, expansion, and other dimensions of service quality. For example, environmental rules affect both corporate cash flows and cost of service.

Industry performance is related to regulatory rules regarding how utilities and consumers will share the upside or downside returns on investment, and to penalties imposed on utilities for missing targets for network expansion. Ultimately, politicians and consumers care that the country's infrastructure networks perform well. They care that prices are in line with costs and that appropriate innovations are adopted so that service is comparable to that in peer countries. If citizens are dissatisfied, governments may press for reforms. Sometimes reform efforts are precipitated by a crisis: service quality that is less than expected, excessively inefficient operations or, in the case of public enterprises, financial problems that place an unsustainable drain on government resources.

Corporate governance reflects the decision rights, implementation responsibilities, incentive programs, and auditing/reporting systems of publicly or privately owned organizations. In the U.S., Congress is investigating the *enronization* of infrastructure, which allows a company to write the rules, limit the umpire's role, play the game, and report the score to affected stakeholders. With the Enron debacle and the collapse of WorldCom, it is clear that investors (and citizens) cannot take manager-provided information for granted. Independent auditors have failed in their fiduciary responsibilities. Investors are hurt by lack of credible information, poor internal incentives for executives, and cozy relations among subsets of stakeholders. Perhaps "old age" has set in for key U.S. regulatory institutions—from the Securities and Exchange Commission to the sector regulators. Corporate governance is one factor that deserves greater attention, though we need to avoid measures more harmful than existing problems.

Nations just entering the regulatory life cycle can learn from mistakes made in the U.S. and can strengthen the private (and public) corporate governance procedures while improving the information flows to investors (and citizens). The checks and balances within public and private utilities need to be reinforced by rules for information disclosure and penalties for financial reports that mislead the public.

Our recent problems seem to characterize infrastructure industries. Experience with infrastructure investment provides at least four lessons:[9]

- *Information and incentives drive performance.* The water industry in the U.S. is large and complex, with average citizens taking little interest in policymaking except when it has a direct impact on pocketbooks. No single national agency

[9]Consider one emerging nation's experience with a network industry. Entrants into the sector devoted considerable managerial attention and financial support to shaping national policy toward the industry. Political contributions to regional and national legislators led to government's helping firms attract international investment capital. However, corporate insiders gained at the expense of shareholders by padding construction contracts (from which they benefited). The entrepreneurs obtained great wealth but the companies became debt-ridden and many finally fell into bankruptcy. Constructed with poor designs and materials, portions of new infrastructure networks needed to be re-built almost immediately. Bribery and corruption characterized the industry, as field supervisors and contractors misallocated resources to personal advantage. Where and when did these events occur? The answer: the United States, in the last half of the 1800s. The history of the U.S. transcontinental railroad reminds us that private and public fraud is not new to the development of network industries (Bain, 1999).

collects data that would facilitate careful benchmark comparisons. State utility regulators seldom have responsibility for all the water utilities in the state because of different ownership arrangements across utilities. The lack of systematic benchmarking in the U.S. suggests that utility managers dislike having utility performance compared to the performance of other utilities in similar situations.

- *Systems of accountability influence performance*. Large projects with substantial sunk costs can result in opportunistic behavior by various stakeholder groups. One reason for creating an independent regulator for the water/wastewater sector is to provide private investors with greater confidence that rules will be set in a transparent and predictable manner—without excessive attention to the next local (or national) election. Clearly, regulators are part of the political system, but by insulating them from daily political power struggles, they are in a position to establish incentives for long-term investment and productivity growth.

- *What you see depends on where you sit.* Entrepreneurs, equity-owners, debt-holders, governments, and input suppliers have conflicting interests. Unfortunately, without appropriate government oversight, the drive for money or power can result in waste, theft, and significant wealth re-distribution. We know that private and public corruption lead to poor industry performance. The question is how to create incentive systems that channel effort into improving performance. Recent developments in the U.S. underscore the importance of financial accountability and strong corporate governance as complements to effective sector regulation.

- *The economic regulator plays a pivotal role in promoting efficiency and fairness*. To avoid economic inefficiency and social inequity, the oversight agency must have an appropriate legal mandate, a shared set of operating principles reflecting national values, and a budget that enables the agency to perform the activities necessary to implement good incentives (Berg 2000). An infant agency must explain its role to stakeholders to lay the foundations for legitimacy. During the youth phase, continued interaction is necessary to prioritize objectives and to explain the rationales for new initiatives.

While we have a track record of some regulatory successes, the U.S. has had significant lapses in the areas of regulatory design and corporate governance. The Savings and Loan scandals resulted in the losses of hundreds of billions of dollars. Most recently, the California electricity crisis and the collapse of Enron, Global Crossing, and WorldCom suggest that energy and telecommunications present significant public policy problems even in mature developed economies. We do not know the extent to which these recent failures will reduce investor interest in infrastructure, although it seems that they will dampen enthusiasm for network projects that involve long time horizons and depend on sound corporate governance and on consistency in government policies. In the case of emerging markets, the costs of delayed and mismanaged investments will be significant. Investors face other opportunities and will turn to regions of the world where the risks and rewards are more favorable

Thus, the behavior and performance of firms depend on corporate governance. Regulatory policies can improve the situation by providing investors with some kinds of data that might otherwise be unavailable—via yardstick comparisons across firms and comprehensive reporting requirements. In retrospect, it is clear that government oversight in this area was severely lacking in the United States. Politicians should have devoted more attention to designing agencies that could help owners and potential investors understand the actual performance of firms; instead, they found the "blame game" an easier and more attractive response.

Concluding Observations

Operating principles are generally developed in an agency's infancy. These are often codified in mission statements. The shared values so essential for an agency's success have also been labeled the *organizational culture*:

> Culture is . . . a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. (Schein, 1992, p. 12)

For example, the Australian Competition and Consumer Commission's nine best practice principles of good regulation represent an effort to be intentional regarding the process.[10] Newly hired professionals are (presumably) exposed to these ideals. They learn how the agency has attempted to make the concepts operational so that routine tasks and key decisions reflect the weights given to each aspect of the process. Second-generation reforms can involve reviewing how values are explicitly communicated within the commission. A regulatory scorecard that evaluates how well an organization lives up to its own standards would seem to be an important initiative for an agency moving into the next phase of the regulatory life cycle.

Ultimately, the legitimacy of a regulatory system depends on how actual sector performance compares against the expected performance articulated by political leaders. Absent quantifiable goals and prioritized objectives, it would be difficult to create scorecards for the first two stages of the regulatory cycle. Part of regulatory reform involves revisiting performance objectives for the water sector. Clearly, if the targets associated with those objectives are unrealistic, the regulatory process will be perceived as having failed. Thus, identifying and communicating key objectives is an important task for policymakers. The vision should stretch capabilities—but not be unrealistic. If visions are not grounded in reality, rhetoric rules the day—leading to disappointment and to a denial of legitimacy for regulatory commissions. In their role as educators, regulators must interact with the various stakeholders, set realistic objectives, explain

[10] These principles include communication, consultation, consistency, predictability, flexibility, independence, effectiveness and efficiency, accountability, and transparency.

how policies have been designed to promote good sector performance, and monitor the degree to which goals are achieved.

We do know that when important social objectives are realized, policymakers, managers, and consumers are likely to be content with the outcome. A record of accomplishment yields broad support for industry, government, and the regulatory system that devised efficiency-enhancing incentives. With improved performance, stakeholders gain confidence in the regulatory system. They trust the agency that facilitates higher levels of service penetration and improved prospects for other sectors that depend on access to affordable clean water. A widely accepted regulatory system can move a nation away from remaining inefficient outcomes. The U.S. still has a long way to go before its patchwork of regulatory agencies and rules can be described as either efficient or fair.

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Appendix: Outline of Water Regulation in the United States—mid-1990s (Sanford Berg and Benjamin Blair)

This outline is derived from a PURC Report prepared for the World Bank (September 1994). Although the references are somewhat out of date, the basic framework for examining water sector issues should be useful for making cross-country comparisons.

1. Current Sector Structure

1.1. Basic Conditions

1.1.1. Supply Conditions

Input: Natural water supplies occur in two main forms - surface water and groundwater. Different sets of rules have evolved concerning the ownership of these two forms.

Technology: Ninety percent of the US population receive their water from a central water supplier or water utility. Public water supply is considered an essential service and water utilities have traditionally been viewed as natural monopolies (Beecher and Mann 1990). Investments involve "lumpiness" (indivisibilities).

1.1.2. Demand Patterns

- Price responsiveness varies depending on use (e.g., residential vs. agricultural).

- Excessive emphasis on engineering rather than behavioral issues has lead to a neglect of pricing and costing issues. This is reinforced by the view that, as a "necessity," water should be exempted from financial considerations.

- Demographics: Population growth can put strains on systems.

1.1.3. Third-Party Effects

- Groundwater as a common property resource
  Certain forms of use by one group preclude use by another. This leads to conflicts within and between states over water rights. Each state has authority over the creation and regulation of water rights within its boundaries. Different sets of rights have evolved between the water-rich eastern states and the water-poor western states.

- Environmental concerns raise issues

- Public safety: water as an input for fire-fighting (water pressure)

1.2. Industry Structure

1.2.1. Output: Public supply was estimated at 36,500 mgd in 1988. (NRRI 2/90)

1.2.2. Sources: 60% of public water supplies is from surface water; 40% from groundwater sources. (NRRI 2/90)

1.2.3. Uses: 84% of public water is used for domestic and commercial uses; 16% is for industrial purposes. (NRRI 2/90)

1.2.4. Service: 90% of the US population is served by central water suppliers; 10% are served by private wells and other systems.

1.2.5. Number: In 1986 there were 52,509 water systems in the US. (NRRI 2/90)

1.2.6. Ownership Patterns: As of 1986, 45.5% of water systems were publicly owned, 28% were privately owned and 26.5% were ancillary systems associated with mobile home parks, schools, hospitals, etc. (Beecher, Mann and Landers, 1990, Table 2-1, p. 20).

1.2.7. Size Distribution: Many small systems serve a small portion of the population while a few large systems serve a majority of the population: 88% of water supply systems serve 11% of the population. 1 % of the systems serve 54% of the population. Only one privately owned system serves a population exceeding one million. (Beecher and Mann, 1990, Table 2-3, p. 26).

2. Political System

2.1 Federal Government

2.1.1 Jurisdiction over navigable waters and interstate commerce

2.1.2 Implications for water supply

2.1.3 Project development and financing (construction grants programs)

2.2 Regional Authorities

2.2.1 Multi-state impacts: water use, flood control

2.2.2 Interstate cooperative agreements

2.3 State Regulation

2.3.1 Water resources, some public utilities, environmental/public health

2.3.2 Fragmentation of responsibilities

2.4 Local Regulation

2.4.1 Publicly owned municipal utilities

2.4.2 Inter-city agreements for cooperation and joint supply

3. Regulatory Institutions, Responsibilities and Decision-Making Procedures

3.1. Federal Government

3.1.1. Congress has constitutional authority to regulate interstate commerce, of which navigable waters are an integral part. Given this authority, Congress has enacted many laws affecting the nation's water supply. (See Table 2-1, p. 35, Beecher, Landers and Mann, 1991.) At least 12 congressional committees and 23 subcommittees influence federal water resource policy.

3.1.2. The enforcement of these statutes falls under the authority of many separate federal agencies (see Table 2-2 p. 36 Beecher, Landers and Mann, 1991). For descriptions of federal agencies and their programs, see Appendix A p. 185 Beecher, Landers and Mann, 1991(adapted from Section 16 of the Utah State Water Plan).

3.1.3. Historically, the federal role was project development and financing (flood control, navigation, storage, etc.), but trends are toward more involvement in issues of quality and management. The “new federalism” of the 1980s resulted in a shifting of costs and administrative responsibilities to the states.

- Federal Water Pollution Control Act Amendments of 1972.
- Clean Water Act of 1977.
- Water Resources Development Act of 1986.
- Safe Drinking Water Act of 1974, 1977, and 1986.

3.1.4. Recent proposed legislation has also addressed new issues in conservation.

- Municipal and Industrial Conservation Act of 1989.
- National Plumbing Products Efficiency Act of 1989.
- National Water Conservation Act of 1988.

3.1.5. "Reserved rights" to water supply

- When the United States sets aside land for the, establishment of a park, military base, national forest, or Indian reservation, sufficient water is reserved to fulfill the purposes of the project.
- The courts ultimately decide conflicts between the federal government and the states over water rights.

3.2. Regional Interstate Water Agencies

3.2.1. Competition and Cooperation

- States that share access to water supplies compete for its use. Conflicts that arise are resolved either through adjudication or the establishment of regional compacts.

3.2.2. Agency Formation and Function

- There are 15 major interstate water agencies established by interstate compacts through which states agreed to allocate and manage a common water resource. These allow states to handle conflicts (such as diversions) and emergencies (such as floods and droughts). Agency role may be advisory or enforcement. (See Table 9-6, Beecher and Laubach, 1989.)

- Formation of regional compacts requires the approval of Congress under the consent provision.

3.2.3. Number of agencies: 41 states and the District of Columbia belong to one or more of these interstate commissions. Federal government is signatory party in some cases.

3.2.4. Four types of interstate agencies

- Water allocation compacts (e.g., Colorado River compact)
- Pollution control compacts (e.g., Klamath River compact)
- Planning flood control compacts (e.g. Red River of the North compact)
- Comprehensive regulatory and project development compacts (e.g., Susquehanna River compact)

3.3. State Government

3.3.1. States have authority over creation and regulation of water rights.

3.3.2. Paradox in water resource policy: pervasive federal role but primacy belongs to the states. States have exerted primacy in the areas of planning, management, and regulation.

3.33. 1978 National Governors' Association Position on National Water Policy gives 11 principles that sum up the view of the states' role in water policy (see Beecher et al. 1991, Table 2-5, p. 45).

3.3.4. Each state relies on its own laws that govern the withdrawal and use of water. Three aspects of state water law are:

(1) riparian,
(2) prior appropriation, and
(3) hybrid of (1) and (2)

3.3.5. States have enacted legislation addressing the issues of water resource planning and conservation.

- statutory authority of water resources planning and management for each state (Tables 9-8, Beecher and Laubach, 1989, p. 305).

- components of state water conservation programs as of 1982 (Tables 9-11, p. 310, in Beecher and Laubach, 1989).

3.3.6. States may also regulate public water utilities through state public utility commissions. Configuration and authority vary from state to state.

- 46 state public utility commissions (including the Virgin Islands) have the authority to regulate water systems in the US.

- Almost 10,000 water systems (1/5 of the total) are regulated by state PUCs. 15 state PUCs have jurisdiction over publicly owned systems (Tables 3-1, Beecher and Mann, 1990).

- Data on state water utility staff size can be found in Tables 3-9, Beecher and Mann, 1990.

3.3.7. Regulatory and planning bodies vary from state to state and often have a more specific and narrow mandate than PUCs. For example, the Colorado Water Quality Control Commission establishes water quality standards under the Colorado Water Control Act and administers pollution control in conjunction with the office of the Attorney General (Getches 1990).

The Water Conservation Board coordinates joint federal-state planning of projects and financing of public and private irrigation projects. The Groundwater Commission determines rights and regulates water use in designated groundwater basins. Groundwater management districts may be formed within basins to assist the Groundwater Commission. These district boards may have use-regulation and taxation powers.

An example in Florida comes from Schmandt, Smerdon, and Clarkson, 1988. The Water Resources Act of 1972 established 5 regional water management districts responsible for water supply, water contamination, and flood control. The districts remain under state supervision. The management districts are governed by boards whose members are appointed by the governor.

The Department of Environmental Regulation has overall responsibility for integrated long-range planning. Water management districts hold an annual conference that serves as a forum for coordinating and setting long-term goals. Water management districts are financed for the most part by an ad valorem tax. The State Water Use Plan is a major component of the 1985 State Comprehensive Plan. It addresses key issues such as storm water treatment, restoration of natural systems, cleanup of leaking underground storage tanks, and water reuse.

. An example from Arizona also comes from Schmandt, Smerdon, and Clarkson, 1988. The ultimate goal of the Groundwater Management Act of 1980 was to eliminate overdraft (use exceeding regeneration). The Department of Water Resources is responsible for implementing the act, and the governor appoints the department director. The goal is sustainable use by the year 2025 for 3 of the 4 areas. The department has authority to purchase and retire water rights (e.g., buying and retiring farms) to reach its conservation goals and is also responsible for creating a system of grandfathered water rights, establishing per capita usage standards for each management area. The department has authority to levy pump taxes and fines.

3.4. Local Government

3.4.1. Most states recognize the authority of municipalities to distribute water. There is no duty for the municipality to serve customers outside its service area; if such customers are served, the municipality is subject to regulation by the state.

3.4.2. Issues of cross-subsidization and fairness arise for local systems. Prices are used for obtaining revenues for (historical) cost recovery rather than as signals reflecting incremental costs.

3.5. Other Water Institutions (Getches 1990)

3.5.1. Most private companies are investor-owned. Some mutuals are owned by shareholders.

3.5.2. In most states, water companies, and not their customers, are holders of water rights. Exemptions to riparian laws.

3.5.3. Characteristics of water utilities

- Have rights to take water and divert, store and distribute to customers by means of owned facilities.
-May be corporations, partnerships, or sole-proprietorships.
- Water is usually sold as a commodity. Some western states like Colorado consider water to be the property of the state; the utility then charges for distribution.
-Water utilities that meet certain criteria are made public utilities by state statute. In exchange for monopoly status the local utility accepts some form of regulation.

3.5.4. Mutual water companies have the following characteristics.

- Those receiving service are shareholders.

- Such companies are regulated in some states.

- They are not usually permitted to sell water to non-shareholders.

- Water rights held by shareholders. Usually determined by amount of stock held.

3.5.5. Carrier ditch companies

3.5.6. Mutual ditch companies

3.5.7. Irrigation companies

- Organized water users to finance and maintain facilities to transport, store and distribute water to shareholders.

- May be regulated as a public utility if service is provided to non-shareholders.

3.5.8 Irrigation districts, also known as conservancy districts, conservation districts, reclamation districts, water control districts, and fresh water supply districts.

- About 50% of irrigated acreage in the western United States is served by either a private mutual company or public water district. For irrigation from surface water, the figure is close to 100% (Rosen and Sexton 1993).

- May perform electric power generation, drainage and flood control

- Governmental or quasi-governmental status. Formed by special provisions in state law.

- Little public accountability.

- Distribute half the water in the western US, which gives them considerable economic and political power.

3.5.9. Municipal water districts

- Authorized by some states to deal with procurement problems not associated with irrigation.
- In California, municipal water districts or replenishment districts manage resources in a variety of ways, such as adjudicating disputes, preventing salinity intrusion, controlling pumping, and importing supplies.

4. Form of Regulation

4.1. The US Congress is granted constitutional authority over water issues that affect interstate commerce (Article 1, Section 8, Paragraph 3).

4.2. States have statutory authority over water systems that meet certain criteria. States also have authority over the creation and regulation of water rights.

4.3. Congress must approve regional compacts between states under the consent provision (Article 1, Section 10, Paragraph 3).

4.4. Legal systems for water allocation (Getches 1990). Public water supply organizations may differ in their structure across states and even within states for districts authorized under different enabling statues (Rosen and Sexton 1993).

4.4.1. Surface Water and Riparian Rights

Riparians are landowners bordering a waterway. Twenty-nine states in the eastern US give riparians special rights of use for water adjoining their property. These include purity, fishing, access, protection from erosion. Use must be "reasonable" relative to all other users, and all must reduce their usage in case of shortage. These rights are inherent in land ownership and need not be exercised to be kept alive. None of the 29 states has a pure riparian system. Most require permits for use. The issuance of permits admits administrative choice among competing users. Administrators set quantity, term, and conditions of permit. Most states have guidelines for permit issuance. One-half of the states grant perpetual permits. Permits are sometimes available for non-riparians. The most notable exception is for municipal users.

4.4.2. Surface Water Prior Appropriation

Rights that are granted to anyone who puts water to use anywhere, with seniority over anyone who later begins to use the water; i.e., "first in time, first in right". These rights are based on usage and not land ownership, and they remain valid as long as use is continued. Use must be "beneficial" as specified by state law. In case of shortage, water use is based on seniority (Schmandt, Smerdon and Clarkson, 1988). Nine western states base water rights on prior appropriation. Most of these states also require some form of permit to appropriate water. All western states except Colorado have water rights authority vested in an administrative agency. Colorado has a judicial system.

4.4.3. Surface Wastes Hybrid systems

Some states (CA, KS, MS, NE, ND, OK, OR, SD, TX, WA) originally recognized riparian rights but later converted to systems of prior appropriation while still preserving existing riparian rights (so-called hybrid doctrine or California doctrine). For example, public water supply organizations (irrigation companies) in California are legally constituted governmental entities that are endowed with general corporate power and the power to assess property and tax their constituencies. In most cases, they act as trustee for landowners within the district and are limited in this trust capacity to receive and distribute water to landowners. Financing may involve both per-unit charges for water

deliveries, per-acre water availability charges, and tax levies on land. Irrigation districts in California obtain most of their revenue from user charges (Rosen and Sexton 1993). Hawaii has a system of water rights established under the Hawaiian kingdom and amended by state statutes. Louisiana has a water right system adapted from the French Civil Code. Some areas of the Southwest are under a system of Pueblo Water Rights in which present-day successors to agricultural villages recognized by the Spanish or Mexican governments have rights to use all the naturally occurring water within their boundaries.

4.4.4. Groundwater

Three approaches to groundwater rights (Schmandt, Smerdon and Clarkson, 1988) are:

- Rights based on common law in which the user is entitled to unlimited withdrawal. This is still the system used in Texas.

- Rights according to ownership of the overlying ground. A state can either grant equal rights to all landowners or some sort of correlative rights based on amount of land owned (CA, AZ).

- The most widely used system involves water permits issued by state agencies.

5. Content of Regulation

5.1. Determine Structure

5.1.1. Entry/Exit and Certificates - 36 state commissions have power to revoke certificates of convenience and necessity. Certificates are issued to utilities entering new markets, expanding services or building new facilities.

5.1.2. Water systems that meet certain criteria, such as size and geographic area served, are subject to regulation by state public utility commissions. For areas of public utility commission authority, see Beecher and Mann, 1990.

5.2. Constrain Conduct

5.2.1. Rates – All 46 state PUCs have authority determining revenue requirements and rate structure design.

5.2.2. Cost Allocation (Beecher, Mann and Landers, 1990)

- Functional-cost method

- Cost-of-service method

- Peak responsibility method

- Noncoincidental peak, class maximum demand, or Hopkinson method.

- Base-extra capacity method.

- For methods used by the different state commissions, see Table 3-7 p. 57, in Beecher, Mann and Landers, 1990.

5.2.3. Rate Design (Beecher, Mann and Landers, 1990)

-Revenue requirements (RRs) provide the starting point for effective rate design.

-RRs are most commonly determined by rate base or rate-of-return methods.

- Rate structures by utility ownership (Beecher et al., 1990, Table 5-1).

- Rate design alternatives (Beecher et al., 1990, Table 5-2).

- Rate structure approval by state regulatory commissions. (Beecher et al., 1990, Table 5-12). Also see the Ernst and Young water rate survey (Beecher et al., 1990, Appendix E).

5.2.4. Finances

Forty state commissions regulate the finances of investor-owned utilities to some degree; e.g., approval of debt and equity ratios; issuance of stocks, bonds and dividends; financial arrangements for water projects.

5.2.5. Ownership

Forty-one states may require prior approval of a major change in the utility's corporate structure or ownership; e.g., mergers, acquisitions, diversification, transfer of utility assets. "Contributions in Aid of Construction" (CIAC) raises issues for transfer of ownership.

5.2.6. Complaints

All 46 state PUCs provide forums for consumers to bring complaints against the utilities; e.g., bill discrepancies, disconnections, and service quality.

5.2.7. Reports

All 46 commissions may require the utility to file annual or periodic reports concerning financial, operational, or planning data.

5.3. Summary of Regulations Controlling Ground Water Development from the High Plains Aquifer, by State (Speidel, Ruedisili and Agnew, 1988, Table V- 2, p. 302-303). This presents an overview of the various regulations aimed at controlling the use of groundwater.

6. Stakeholder Participation Arrangements

6.1 Water utilities that fall under the jurisdiction of state PUCs may request commission action on water rates, ownership issues, special service fees, and commission rules and policy. See Table 3-3, p. 77 in Beecher, Mann and Stanford, 1993, "Survey of Commission Proceedings on Water Utilities, 1986 to 1992."

6.2. Opportunities for citizen involvement in the implementation of each of eight federal statutes that serve to protect groundwater are presented in Table 30-1 p. 328, in Speidel, Ruedisili and Agnew, 1988, "How Citizens Can Use the Federal Laws to Protect Groundwater."

6.3. Allocation of water permits allows the issuing agencies to weigh public and private interests.

6.4. All 46 states that have some jurisdiction over water utilities provide forums so that consumers can bring complaints against the utilities regarding such things as bill discrepancies and service quality.

7. Future Directions

7.1 National Developmental Priorities

7.1.1. Interstate Coordination

Because of the regional nature of many water issues, the role of the interstate agencies and planning boards may become more pronounced.

7.1.2. International and Domestic Sales of Water

- Anchorage Water and Wastewater Utility has excess water. Alaska Glacier Beverages is trying to set up a deal to sell this water to Saudi Arabia. City is receptive but wants some guarantees (Bauman, 1994)

- State officials are working to open up a market for sale of water to the "lower 48" states. Interest in a pipeline to link Alaska and the U.S. West Coast. Also delivery by tanker. Alaskan legislature has already passed a law that sets up a mechanism for water sales. The purchasers of the water envision a system of exchange agreements. For instance, Nevada could buy Alaskan water and trade it to California in exchange for a portion of California's Colorado River water (Bradner, 1993).

- Possibility of significant imports from Canada in the future once the internal debate in Canada over the issue is resolved.

7.1.3. Water quality, availability and prices are likely to raise tough trade-offs.

7.2. Market Structure

7.2.1. Traditional water utility delivery systems imply natural monopoly.

7.2.2. New forms of regulatory oversight may be called for.

7.3. Content Regulation

It is accepted that total deregulation of water systems would be unwise; however, some gains may be possible through partial deregulation or alternative regulatory policies. Some suggestions follow (Beecher and Mann, 1990).

7.3.1. Selective Exemption -a utility is exempt from state commission rules if certain criteria, such as minimum size, are met.

7.3.2. Industry Restructuring - regionalization, acquisition, merger to take advantage of economies of scale.

7.3.3. Regulatory Expansion - allowing state commission jurisdiction to include municipals.

7.3.4. Selective Simplification -simplify filings, proceedings, and reporting.

7.3.5. Operating Ratios - substitute traditional rate-base regulation with operating ratio regulation.

7.3.6. Generic Rates of Return - standardize rates of return for regulated water utilities.

7.3.7. Safe Harbor - use trigger mechanisms to turn state regulation on and off.

7.3.8. Competitive Bidding - either auction both ownership and operation or allow public ownership and auction operations.

7.3.9. Excess Profits Tax - remove entry restrictions and rate controls and instead tax the firm's earnings.

7.3.10. Price Caps and Rate Indexes - place upper limits on water prices. Shifts focus from rate of return to operational performance.

7.3.11. Social Contract - agreement between water utility and commission in which rate increases are limited and indexed and increases in quality of service are promised.

7.3.12. Incentive Regulation - gives utilities incentives to improve performance.

7.3.13. Contributions in Aid of Construction (CIAC) - raise issues for establishing revenue requirements and for valuing the rate base if ownership is transferred.

7.4. Institutional Capacity to Regulate

7.4.1. Jurisdictional conflicts

7.4.2. Technical expertise

7.4.3. Deregulation in practice

- Iowa, Arkansas, and Oregon have deregulated small privately owned water utilities.

- West Virginia has partially deregulated publicly owned water utilities.

- Florida, Rhode Island, and Wisconsin States have initiated studies of reduced regulation

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