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MUNICIPAL WASTEWATER TREATMENT: PRIVATIZATION AND COMPLIANCE

by

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EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) estimated in 1992 that \$137.1 billion is needed for wastewater treatment over the next 20 years. Partly in response to these funding needs, the EPA established the Public-Private Partnerships Initiative (now Partners Rebuilding America program). This move toward privatization offers the prospect for improved compliance of wastewater treatment standards, more cost-effective wastewater treatment service, and greater accountability in the design, construction, and operation of facilities.

Despite these benefits, Congress and the EPA may not discontinue federal funding programs for wastewater treatment in 1994 as originally planned. In 1991, Sen. Max Baucus (D-Mont.) proposed a partial return to the grant system that funded many facilities over the past several decades. And several bills propose to extend federal funding of state-revolving funds beyond 1994.

Extension of these federal funding programs *all discourage communities from discovering innovative ways to meet their treatment needs*. Federal grant programs created disincentives for local communities to comply with water treatment standards, since failure of the federal government to provide funds was an acceptable excuse for noncompliance. Moreover, grant regulations slowed the process of constructing or upgrading facilities to comply with wastewater treatment standards, adding an average delay of two to four years. Finally, the process made it difficult to identify and hold accountable those responsible for provision of inaccurate or improper advice.

State-revolving funds (SRFs) are an improvement over the Construction Grant Program. However, the SRF program still inhibits efficient investment in municipal wastewater treatment plants capable of meeting effluent standards. Like the CGP, SRF funding discourages local governments from developing self-sufficient, efficient, and effective wastewater treatment programs.

Privatization offers an alternative means of funding and operating wastewater treatment facilities. According to EPA, five benefits result from use of public-private partnerships: 1) access to more

sophisticated technology; 2) cost-effective design, construction, and/or operation; 3) flexible financing; 4) clear delegation of responsibility and risk; and 5) guaranteed costs.

Accountability provided in privatization contracts ensures that a private operator will either meet the contract standards established by the local government or face penalties such as fines or contract termination. Clear assignments of responsibility are linked to accountability through the privatization contract.

Although various forms of privatization have been pursued in hundreds of communities throughout the United States, numerous factors restrict the ability of communities to fully capture the advantages provided by private-sector participation in the provision of wastewater treatment.

To support further wastewater treatment privatization and the development of cost-efficient, reliable municipal wastewater treatment plants the federal government should pursue its plans to discontinue the SRF loan program, ease federal regulations associated with existing funding, and modify tax laws that discourage use of tax-exempt bonds for privately owned facilities.

At the state level, regulators should allow communities maximum flexibility in designing the best partnership to meet their needs under EPA's Partnerships Rebuilding America privatization program, and eliminate any state restrictions on use of SRF loans to help finance privately owned facilities.

In pursuing privatization, local officials should ensure that privatization contracts establish clear responsibility and accountability by requiring insurance to cover bankruptcy and maintain service; the right of first refusal if the private firm wishes to sell; and by specifying the terms under which the local government can change the O&M provider and the conditions under which O&M fees can be increased.

Table 1

SECONDARY TREATMENT COMPLIANCE AS OF JULY 1, 1988		
POTWs	Universe	In Compliance
Major POTWs (>10,000 pop. or 1 MGD)	3,731	88%
Minor POTWs (<10,000 pop. or 1 MGD)	11,755	85%

Note: "Universe" includes all plants except for those whose operational discharge data were not confirmed and those who were not in compliance but expected to be by September 30, 1988.

Source: Roger Truitt, "Noncompliant POTWs Can Minimize Penalties With a Proactive Strategy," *WATER/Engineering & Management*, Vol. 135, 1988, p. 22

I. INTRODUCTION

In February 1991, the United States Environmental Protection Agency (EPA) released a report which claimed that "a strong enforcement program is one of our highest priorities for the Agency" and "we must maintain an enforcement program that will...promote pollution prevention." James M. Strock, then Assistant Administrator for Enforcement, stated in his introductory letter that "enforcement is the means by which we assure that the promise of our environmental laws and regulations are realized."

EPA regulators believe a stronger emphasis on enforcement is the most promising way to improve compliance rates of municipal wastewater treatment plants. Prior to its increased enforcement efforts, the EPA sought to improve performance and ensure compliance through technical support and training assistance combined with financial aid through the municipal wastewater treatment Construction Grants Program (CGP). This program, established as part of the 1972 Federal Water Pollution Control Act, provided approximately \$60 billion in grants and loans to help fund municipal wastewater treatment systems. In many ways, the program directly linked compliance enforcement with a community's financial ability to construct or upgrade a plant. As a result, enforcement measures were rarely applied to communities eligible for federal funding, even if the community's plant routinely violated federal standards.

The Water Quality Act of 1987 signaled the end of federal funding for municipal plants as direct federal grants to communities were phased out and replaced with loans from State Revolving Funds (SRFs). While the federal government has provided initial capitalization grants to help establish SRFs, all federal assistance is scheduled to end in 1994. At that time, states and municipalities will share responsibility for funding wastewater treatment plants, and the lack of federal funding will no longer be an acceptable excuse for noncompliance. This significant change in federal policy led environmental attorney Roger Truitt to warn that "not only has EPA exchanged its carrot for a big stick, but it now appears the EPA intends to use it whenever necessary to secure compliance."

Funds available through SRFs are only a small fraction of funds needed to upgrade municipal plants. EPA's 1992 Needs Survey estimates that \$137.1 billion is needed for wastewater treatment needs over the next 20 years. Partly in response to the lack of funding, the EPA established the Public-Private Partnerships Initiative. Currently known as Partners Rebuilding America, this program was created primarily to develop "innovative financing approaches" to construct or maintain plants without federal funding. Through this program the EPA intends to increase private-sector involvement in wastewater treatment from financing to ownership. Although public-private partnerships or privatization has been viewed by the EPA predominately as an option to relieve the financial burdens of municipal plants, the agency also recognizes that privatization reduces costs, speeds project construction, guarantees proper performance, and preserves jobs.

There is some indication that Congress and the EPA may not turn over wastewater treatment responsibility to the states and local communities in 1994 as currently planned. In 1991, Senator Max Baucus (D-Mont.) proposed legislation which called for a partial return to the grant system. Testimony before the Senate Committee on Environment and Public Works' Subcommittee on Environment, charged that "recreation of grants for a range of specific purposes will predictably cause communities to defer indebtedness for needed treatment facilities based on the assumption that grant money may be on its way." Roberta H. Savage, Executive Director of the Association of State and Interstate Water Pollution Control Administrators stated, that "reliance on grants will delay compliance, reinforcing the appearance that if a local community puts off solving their problems long enough, the federal government will eventually come to their rescue."

Several bills propose to extend federal funding of SRFs beyond 1994. Others seek to allocate a portion of federal funding for direct grants to specific projects or encourage suspension of the 20-percent state matching grant requirements. Extension of federal capitalization grants, conversion of loans to grants, provision of grants to specific communities and elimination of state matching funds all encourage communities to view wastewater treatment as a federal responsibility and discourage communities from discovering innovative ways to meet their treatment needs.

From this legislative context, the recent trend of municipal wastewater treatment privatization and the relationship between private involvement and compliance is important. To grasp the fundamentally different consequences of private and public-sector involvement in operation and ownership, it is necessary to examine factors which affect a treatment plant's performance as well as factors which provide incentives for local governments to pursue compliance with federal water-quality standards. In addition, it is useful to investigate how privatization can improve plant performance without the need for additional federal expenditures or increased enforcement efforts.

To complete the goals of this paper, two clarifications are necessary. First, compliance is usually defined with respect to the National Pollution Discharge Elimination System (NPDES) permits. This system is one of the ways in which the EPA evaluates a plant's performance. However, this is not the only way to measure compliance. The Federal Water Pollution Control Act (FWPCA) and its amendments have established other criteria that municipal wastewater treatment plants must satisfy. Thus, although compliance rates stated by the EPA and other government agencies normally refer to the percentage of plants producing effluents that do not exceed the allowed parameters of their particular NPDES permits, this is not always the case. The ability of plants to meet other requirements such as secondary treatment guidelines or specific technology requirements can also be used as an indicator of compliance.

Second, since NPDES permit effluent limitations are set at levels which are believed to be effective and achievable, and plants are designed on the basis of meeting these levels, the water-quality goals of the FWPCA and its amendments, as well as the regulations and NPDES effluent permit limitations established in their support, are taken as given for this study. The merit of the water quality goals and the effectiveness of the permit limitations set in their support will not be judged on any grounds including their impact on water quality and human health.

II. MUNICIPAL WASTEWATER TREATMENT PLANT COMPLIANCE

A. Compliance History

The Federal Water Pollution Control Act of 1972 and its amendments provide the basis for the current policies regulating municipal wastewater treatment plants. This act represented the first attempt by the federal government to take responsibility for establishing water quality goals and enforcing regulations and to also establish specific plans to achieve the goals. The act's purpose was to "restore and maintain the physical, chemical and biological integrity of the nation's waters." The two main goals were to achieve "fishable and swimmable" water by 1983 and to eliminate all discharges of pollutants into navigable waters by 1985.

In support of these goals, the act established the National Pollutant Discharge Eliminate System (NPDES). Compliance with the NPDES is routinely used as one way to evaluate plant performance. This system requires point-source dischargers to obtain a permit before commencement of discharge.

Each permit specifies the type and amount of specific pollutants allowed as well as a time schedule by which compliance with the limitations is required. For regulatory purposes, the permit also specifies sampling methods and schedules as well as requirements which outline the obligation to report collected data to the appropriate regulating authority.

Before the passage of the FWPCA, effluent limitations were set by individual states. The FWPCA required effluent limits to be based upon what was technologically achievable rather than what a particular state thought was best for its own water. Thus, all municipal wastewater treatment plants (MWTPs) were required to meet effluent standards achievable through the use of "best practicable waste treatment technology." Although the descriptive technological titles and the corresponding levels of treatment have changed, these particular effluent limitations have always been linked to a specific technological capability.

The FWPCA required municipal dischargers to meet "secondary treatment" guidelines by July 1, 1977, as well as to install "best practicable water treatment technology" (BPT) by July 1, 1983. Soon after the act was passed, the EPA estimated that 50 percent of existing municipal dischargers would not be able to meet the secondary treatment guidelines by 1977. Based on data from the 1976 Needs Survey, the Water Pollution Control Federation estimated that only 33 percent of municipal dischargers would be able to meet the secondary treatment deadline. As late as September 1978, the EPA stated that "[a]n analysis of compliance indicates that the majority of publicly owned treatment works (POTWs) have not completed construction necessary to meet the 1977 treatment requirements."

In 1977, amendments to the FWPCA were passed and the act was renamed the Clean Water Act (CWA). This act changed several of the deadlines facing municipal treatment plants. Any plant that discharged into marine waters was allowed to apply for a waiver of the secondary treatment guidelines if the discharge was not harming the ocean environment. An extension of the 1977 deadline until 1983 was available to plants that lacked adequate federal funding to complete necessary construction by the 1977 deadline. The 1981 Construction Grants Amendments extended this deadline to July 1, 1988.

In December 1983, a United States General Accounting Office (GAO) report to the EPA Administrator stated that "noncompliance with permit limits was widespread, frequent, and significant." The GAO randomly selected 531 major dischargers (municipal and industrial) and found that:

"municipal dischargers exceeded their permit limits more frequently than industrial dischargers. For example, about 59 percent of the municipals exceeded their concentration limits for more than six months while only 33 percent of industrials exceeded those limits for more than six months in the eighteen-month period reviewed."

Of the dischargers experiencing "significant noncompliance," defined as exceeding permit limits "for one or more pollutants" by "50 percent or more for at least 4 consecutive months," 69 percent were municipal.

By the time National Municipal Policy enforcement rules took effect in 1985, more than 60 percent of the nation's major municipal plants were meeting effluent limitations. Of the remaining plants that needed upgrading, 70 percent achieved compliance by the July 1, 1988 deadline. Approximately 30 percent of the more than 400 remaining plants were considered "technically in compliance" because they were subject to legally enforceable compliance schedules.

The EPA estimated that 88 percent of the major municipal dischargers were in compliance by the July 1, 1988 deadline for secondary treatment. This is a significant increase in just three years. Table 1 shows that 85 percent of minor municipal dischargers met the same goal. However, not all dischargers

are included in EPA's study. The universe figures include all plants except for major dischargers who were operational but whose discharge data were not confirmed and major dischargers who were currently not in compliance but were expected to be in compliance by September 30, 1988.

EPA stated that as of January 1990, "89 percent of all major municipals...(had) completed construction to meet final effluent limits." As with earlier compliance figures, this statement does not include plants experiencing difficulties with operation and maintenance or other problems which prevent compliance but do not require construction to improve performance. In addition, it does not include those plants subject to interim limits as part of an enforceable compliance strategy designed to meet final limits.

As late as 1992, the GAO reported that compliance problems "have not been fully documented" as EPA's compliance monitoring "is limited to major and significant minor wastewater treatment facilities." Twenty percent of states believe noncompliance will increase, especially as new wastewater regulations such as stormwater permits and toxic discharge limits are enforced. Utah has expressed concern that its state health department may be forced to condemn entire towns unable to afford wastewater plant upgrades.

B. Interpretation of Compliance Figures

Several limitations impact evaluations of the significance of the above compliance figures. For example, a number of those plants studied in the GAO report were experiencing significant noncompliance problems. Significant noncompliance, as described above, indicates that these plants are routinely discharging prohibited effluent rather than experiencing a one-time problem. Thus, although two plants can receive the same volume of inflow and both be defined as not complying, it is possible for one plant to experience a greater number of individual violations, and thus treat a larger amount of water in a prohibited manner. It should also be recognized that compliance figures are based on individual plants rather than the quantity of water treated. It cannot be determined what percentage of water is not meeting permit limitations, only what number of plants are experiencing compliance troubles. Further, compliance as defined by the EPA only refers to plants which have permits and therefore are able to comply or not comply with permit limits. Thus, if all the plants that needed permits had permits, noncompliance figures might be significantly higher.

In 1984, the EPA permit backlog was estimated at 16,062 applications, most of which had been on a waiting list since 1982. Over 98 percent of the applications were for minor municipal plants. Because of inadequate funding, staff shortages, and the complexity of the permit process, the EPA could not even *identify* all the plants needing permits. Even when identified, some EPA regions or states did not attempt to permit minor dischargers. In one EPA region, the waiting list of permit applications was so long that only the major permits were ever examined. The region did not issue more permits than the number which could be adequately supervised.

By the end of fiscal 1992, the nationwide permit backlog accounted for 15 percent of the 583 major municipal plants and 29 percent of the 3418 minor municipal plants. If this large number of unpermitted minor dischargers receive permits, overall municipal compliance rates may drop as minor dischargers historically have lower compliance rates than major plants.

Finally, a knowledge of the procedures used to monitor, sample, and evaluate effluent quality is essential to an understanding of compliance. Compliance rates, even for a well-defined class of plants, do not actually indicate the percentage of plants producing effluent within the permit limitations. There are several reasons why this discrepancy may exist. For example, the existence of a violation may never be revealed to the regulatory agency. This may be because the violation did not coincide with

sampling or the discharger did not file the required discharge monitoring report (DMR). The GAO has reported that "serious discharge noncompliance" could be concealed by the large number of incomplete or missing DMRs.

Even if a plant submits a DMR with the quantity or type of effluent in violation of permit limitations, noncompliance is not always assumed. The same GAO report stated that not all EPA regions or states treat incomplete DMRs as violations, and many laboratories analyzing the discharge as part of the DMR preparation are not able to perform an accurate analysis of the effluent. Through its Discharge Monitoring Report Quality Assurance Program, the EPA submits samples to laboratories analyzing effluent in an attempt to ensure accuracy. Results from its 1980 and 1982 surveys revealed that 68 percent of municipal samples were analyzed incorrectly for one or more pollutants. The determination of compliance is somewhat subjective in that the regulatory agency must determine by what amount the effluent limitation can be exceeded. Commonly, "monthly averages below the criterion are accepted by the regulator as demonstration of proper performance" but the question remains as to whether a reported "monthly average concentration of 1.01 mg/L, [milligram per liter] 1.1 mg/L, or 1.5 mg/L is a violation" of a 1.0 mg/L permit limitation.

Even with these noted limitations, these figures indicate that a significant number of individual plants have experienced difficulty complying with permit requirements. However, it is obvious that the above compliance figures are inadequate to evaluate the effect of compliance on the amount of water treated, or even the general progress toward the goals of the FWPCA. The terms, "compliance," "noncompliance" and "significant noncompliance" have a number of different definitions and can be applied to several different requirements established under the FWPCA and its amendments.

III. ASSESSMENT OF MUNICIPAL WASTEWATER TREATMENT PLANT PERFORMANCE

A. EPA Performance Evaluations

As part of the 1972 FWPCA, the EPA Administrator is charged with conducting an annual survey to compare the efficiency of wastewater treatment plants constructed with federal grant funding with the efficiency planned for the plant before it was built. Four years after the act's passage, Walter G. Gilbert, chief of EPA's Municipal Operations Branch in the Office of Water, used these annual surveys as a data base to determine the relation between operation and maintenance (O&M) and MWTP performance. These surveys, combined with data from an EPA operation and maintenance program started before the passage of the FWPCA, provided data needed to evaluate 1,517 municipal plants.

To determine if plants were meeting their original design performance objectives, Gilbert focused on five-day biological oxygen demand (BOD) and total suspended solids (TSS) removals. His results indicated that one third of the plants failed to meet the designed BOD removal criteria and one half failed the designed TSS criteria. A similar survey, conducted by the State of Illinois, also indicated that plants built with federal grant money were not meeting design criteria.

Gilbert also examined the ability of the secondary treatment plants to meet secondary treatment standards as defined by the FWPCA. This level of treatment required at least an 85 percent removal of both BOD and TSS, but in no case was the effluent allowed to contain more than 30 mg/L of either parameter. Although Gilbert's study concluded that less than 50 percent of the secondary plants were meeting design criteria, many of the examined plants were in operation before this level of treatment was established as a goal, and thus not all plants examined were *designed* to meet these parameters.

However, the examination did reveal a positive relationship between operational flexibility and compliance.

Gilbert identified several factors influencing performance of grant-funded plants:

_Plants with detailed maintenance schedules and records consistently performed better than plants with poor records.

_The best performers commonly had an O&M manual that was written specifically for that plant rather than just for that plant's design type.

_Inadequate knowledge of the treatment process led to poor treatment.

_The amount of money spent on training per salary dollar was consistently higher for plants performing above design criteria.

_Excluding plants that were hydraulically or organically overloaded, the most significant factor contributing to poor performance, was the "operator's inability to utilize fully the design capacity of the facility."

Gilbert was one of the first to examine the performance of municipal plants under the FWPCA and identify several of the performance-limiting factors. Compared to the studies and surveys that followed, Gilbert's study was constrained by a limited time frame and lack of complete data. However, later studies reached the same conclusions.

In the mid-1970s, the EPA funded a two-part study of municipal treatment plants in response to data released in the 1973 and 1974 editions of the *Clean Water Report to Congress*. These reports indicated that one-third of municipal treatment plants constructed with federal funding were not meeting design criteria. Initially, two private contractors were hired to "identify, quantify and rank the major factors which limit biological wastewater treatment plant performance." Although the focus was limited to treatment problems resulting from what was commonly described as "poor O&M," the contractors noted that this category actually included a wide range of factors including staffing, salaries, design, management, budget, and traditional maintenance factors.

The results of the study were similar to Gilbert's findings, but much more detailed. The number one performance-limiting factor present, regardless of plant location or treatment type, was the lack of proper "operator application of treatment concepts and testing to process control." This factor was present in all but 2 of the 50 facilities studied and was the leading cause of poor performance at 15 plants. A lack of general sewage treatment understanding ranked as the second highest contributor to inadequate performance. Operators who lacked such knowledge "were not able to explain even to a limited degree the purpose or function of the treatment processes at their plant...their only concern was that the equipment was functional." The third highest factor was a lack of proper technical guidance. Other factors identified included inadequate laboratory procedures, lack of process flexibility, and improper design reflecting "the construction of many incomplete and marginally operable facilities."

Initial results from the study prompted further efforts to identify performance-limiting factors and develop a corrective plan for improving performance. The plan, the Composite Correction Program (CCP), is still used today to optimize municipal plant performance. Although the additional study still focused on O&M, the results revealed that over 20 percent of the plants studied required "major facility design modifications" in order to maintain continuous compliance with secondary standards. Since facilities with noticeable design inadequacies were eliminated from consideration when

choosing the initial plants, it is clear that a significant number of plants have design deficiencies that are not obvious.

Application of the CCP study to noncomplying plants was successful enough that the consultants recommended its further development and application on a broader scale. A final report, based on the full 3½ year study, including detailed evaluations of five plants, produced a number of recommendations directed at five groups of people having significant involvement in the wastewater treatment process.

B. Performance-limiting Factors and Corrective Recommendations

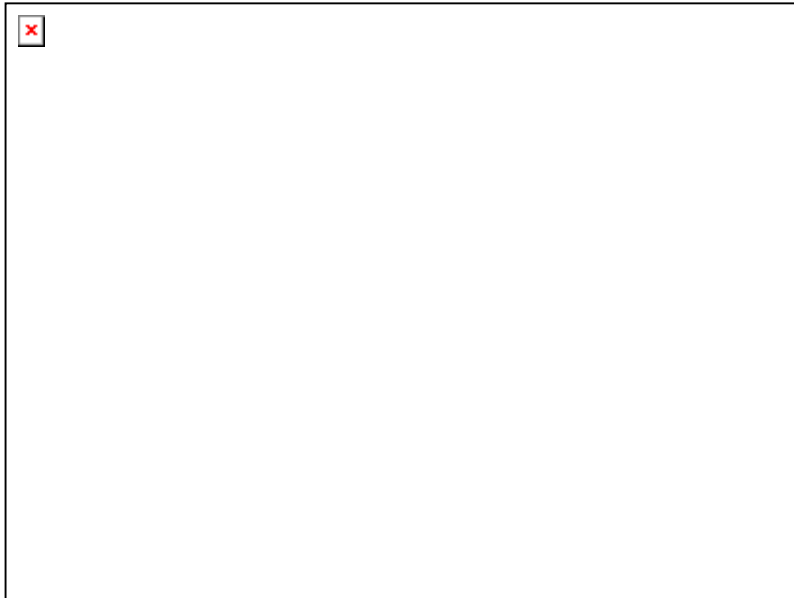
Performance-limiting factors identified by Gilbert and the CCP study fall into 5 areas:

1. problem recognition;
2. knowledge and training;
3. design, construction, and technology;
4. finance; and
5. enforcement.

Failure to recognize problem areas appears to have significant impact on a plant's ability to comply. The areas which contribute to poor performance cannot be addressed until they are recognized. Failure to recognize the problems allows continued poor performance. Examples that illustrate the problem of recognition include the inadequate emphasis placed upon proper training and advice, failure to recognize what design/equipment problems are most likely to occur, poor documentation of the potential performance levels to be expected, and ignorance of the potential for improved performance without the need for additional construction.

Inadequate operator application of treatment concepts, insufficient knowledge of general sewage treatment principles, and incorrect technical guidance have limited the ability of operators and owners to run even those plants without design or budgetary limitations. Knowledge of treatment concepts and proper training are inadequate at a number of levels. Wastewater treatment technology has advanced significantly since the passage of the 1972 FWPCA and the training of operators, staff, regulatory personnel and consultants is not always adequate to design, construct or maintain treatment plants. In response to these problems, the CCP study contractors recommend holding authorities providing technical advice responsible for their actions and increasing state and regulatory officials awareness of the extent to which communities rely on their advice.

Although plants with obvious design flaws or equipment troubles were excluded from the CCP study, the EPA recognized that *"a major conclusion of this survey was that errors in design were severely limiting the operator's ability to achieve maximum performance from the facility."* As a result, the EPA published a handbook to help identify and correct design deficiencies in existing plants and prevent the same mistakes from occurring during the design and construction of new plants. This handbook states that "performance and reliability problems" as well as "poor safety practices" and "decreased flexibility of plant process control" can result from design deficiencies. Design deficiencies include the improper selection of equipment and the inability to make accurate estimates of future plant-operating conditions, including the consistency and amount of inflow expected, which results in construction of improperly sized plants which are difficult to modify or upgrade.



Despite almost \$60 billion granted to plants under the Construction Grants Program, local plants are still facing budgetary restrictions. While EPA's 1992 Needs Survey estimates that \$137.1 billion will be required to meet wastewater needs for the next twenty years, this estimate does not include O&M costs. The lack of money appropriated for training, salaries, and benefits has contributed to poor staff quality and performance. Inadequate expenditures on operation and maintenance needs accelerated plant deterioration and started a vicious cycle of requiring more O&M expenditures to cope with the physical

decline of the plant. As technology advances, O&M costs will rise and communities must be prepared to face significantly higher costs in the near future. As shown in Figure 1, the Association of Metropolitan Sewerage Agencies predicts that O&M expenses will rise at 9 to 11 percent per year, in effect, doubling the cost every eight years.

That the consultants found the lack of sufficient enforcement a negative influence on proper plant performance is not surprising. During the time that the consultants were evaluating specific plants (1980–1982), very few municipalities faced any enforcement under the FWPCA. The consultants concluded that since plants can improve performance through programs like the CCP, more vigorous enforcement would force plants to seek such measures and result in improved operation and effluent quality.

IV. THE EFFECT OF FEDERAL ASSISTANCE FOR MUNICIPAL WASTEWATER TREATMENT ON COMPLIANCE

The financial ability of a community to construct and operate a wastewater treatment plant directly affects the community's ability to comply with the Clean Water Act. In an attempt to equalize the ability of communities to comply with the act, Congress provided enormous amounts of funding for municipal wastewater treatment plants through the CGP. Because encouraging compliance was the program's primary goal, penalties for noncompliance were linked to the financial ability of a community to support a properly operating plant. Compliance deadlines were extended and enforcement efforts were withheld from communities waiting to receive a federal grant. In addition to funding, the federal government also provided technical assistance to ensure efficient use of federal funds and to promote self-sustaining community operation and maintenance programs.

A. Construction Grants Program

The CGP's effects on performance and compliance must be considered for at least two reasons. First, the CGP can be viewed as a positive influence on compliance in that it provided funding for plants that were experiencing significant compliance problems. The Association of State and Interstate Water Pollution Control Administrators, testifying before a House subcommittee on a February 1989

proposal by President Bush to cut funding to the Construction Grants Program, expressed a common belief that with lower funding, "municipal noncompliance will undoubtedly escalate."

A second reason for considering the structure and influence of the CGP is its impact on local government finance and responsibility. The enormous amounts of CGP funds available to local governments frequently displaced local spending for wastewater treatment plant construction and encouraged communities to view wastewater treatment as the federal government's responsibility. In addition, the promise of federal funds specifically provided to increase compliance provided perverse incentives not to comply, as compliance was rarely enforced and noncompliance actually increased the chance that a local government would receive a grant.

The CGP has allocated about \$60 billion in grants and loans for the construction of wastewater treatment plants through individual states. Each state received a portion of the year's allocated funds based on state population and projected wastewater needs. The money was allocated through a required state Project Priority List, which ranked projects in order of need. Initially, states had a tendency to fund projects as soon as they were eligible because unused state money reverted back to the federal government if not used within a specified time period. But, many states found that their share of the federal money was inadequate to meet the state's needs because of stricter funding eligibility restrictions and a limited amount of funding available for each state. As a result, states announced that their share of federal funds would be available on a need basis only. Need was judged primarily on the ability or inability of a plant to comply with regulations. Most states allocated the money to the areas with the worst performance.

Not all municipalities constructing plants during the program's existence received federal funds; however, almost all plants were influenced by the program. Seeing the availability of free federal funds, many plants sought federal funding to upgrade existing plants. Not all of these plants were in need of improved treatment to meet effluent standards. The early period of the program provided federal funding to support reserve capacity that was not needed to improve compliance with the FWPCA. The liberal funding of projects resulted in many communities that, almost twenty years later, still have plants with adequate capacity and low sewer rates.

Local officials desired new plants for a number of reasons. Although the CGP eventually disallowed the funding of reserve capacity, plants were still built with some future needs in mind. Plants were typically designed for a 20- to 30-year period. Many communities realized the importance of wastewater treatment capacity in attracting new industry. New industry created jobs, funded other projects, and contributed to the overall economic welfare of the community. As a result, the desire to construct plants with large amounts of free federal money commonly outweighed the benefits of operating existing plants in a fashion that would achieve compliance.

Many local officials openly admitted to the pressures placed on them by the public to construct new plants and minimize local costs. One official claimed that if the local government tried to finance a new plant with local funding, the sewer fees would increase and "the community would fire them or they'd get voted out of office, and the job still wouldn't get done." This pressure was routinely passed to the plant operators. One operator claimed that he could have improved performance "but was told by the "uptown" officials not to worry about it because doing better would hurt their chance to get a...grant."

The influence of free federal money did not end once the grant was received. As noted, the existence of federal funding encouraged local governments to believe that the financing of wastewater treatment is not primarily a local responsibility. This theme was further impressed on plant operators even after

they received notification of grant funding. The final approval for all aspects of design and construction rested with the EPA. Although the EPA informed them of their responsibility for design and construction, local communities were rarely held accountable when problems arose.

Numerous reports have documented the poor controls over federal grant money. The Comptroller General (1977) reported that grant money had been used to finance construction of such aesthetically valuable features as a "red tile roof," "stucco exterior," "decorative arches," "reflecting pool" and a "mosaic tile fountain," all at wastewater treatment plants. The General Accounting Office (1978) found that "local agencies—the grantees—have not had adequate financial management systems to provide efficient and effective accountability and control over funds received from the Agency."

One town manager admitted that his town was "relatively poor and was not satisfied with merely constructing a plant whose design was compatible with existing surroundings; it wanted the facility to serve as a catalyst for upgrading the area." This particular plant was surrounded by a 15-foot high red tile/stucco fence that cost \$200,000. In another example, federal grants paid for 55 percent of the cost of a \$30,000 mosaic tile fountain constructed for the sole purpose of displaying the effluent from an advanced wastewater treatment plant. One public works director stated that "the program enabled us to add customers and increase our base of operations without having to put a lot of our own money in the thing."

The concern over "our own money" is not unusual. Initially, Congress and the EPA treated lack of funding as an acceptable excuse for noncompliance. Municipalities learned that if federal funds were not available, they would not be forced to comply with the deadlines of the FWPCA. Section 301(i)(1) of the CWA allowed plants not meeting the 1977 deadlines as a result of inadequate federal funding to request an extension until July 1, 1983. The act states that if construction is required to meet discharge limitations, but "construction cannot be completed within the time frame... or the United States has failed to make financial assistance under this act available in time," the Administrator or the state may issue a permit containing a compliance schedule to have the plant construction completed "no later than July 1, 1983." Thus, the act clearly placed responsibility for funding with the federal government, and the failure of the government to provide funds was an acceptable excuse for noncompliance. Simply put, local officials were not held accountable for failure to comply with federal regulations.

Local officials, who realized that a new wastewater treatment plant provided economic benefits to the community as a whole, were faced with a dilemma. Deliberate noncompliance, although technically illegal, was difficult to spot and rarely subject to enforcement, especially if a plant was waiting for a federal grant. In addition, money could be saved by reducing compliance efforts. Compliance, on the other hand, required local O&M expenditure and could actually hinder the chance of receiving a federal grant. As a result, the primary goal of operation usually centered on the ability of the local plant to receive outside grant funding and minimize local costs.

Noncompliance moved a community farther up on the state priority list and encouraged state officials to provide construction funds to improve compliance through the construction of a new plant. Some officials believed that it was impossible to achieve compliance until a grant was received and therefore did not try to improve performance. Others refused to participate in the CCP study fearing that the study might improve plant performance and diminish their chances for a grant. This negative impact of the CGP was so strong and widespread that the CCP study's conclusions included the finding that current "construction grant awarding procedures encourage poor performance."

In 1978, the EPA issued its *Interim National Policy and Strategy for Construction Grants, NPDES Permits, and Enforcement Under the Clean Water Act*, which outlined necessary enforcement

strategies to improve compliance. One of the policy's goals was to "encourage movement into the grant process" by notifying POTWs that if they did not apply for a grant within a certain time period, they would lose the opportunity to receive a grant. The Construction Grants Amendments of 1981 ended reserve-capacity funding and reduced the federal share of design and construction costs to 55 percent. The 1984 National Municipal Policy warned communities that continued lack of federal funding would not be accepted as justification for noncompliance. This policy marked a fundamental shift in the agency's compliance efforts. Federal grants were still intended to promote compliance but a community's lack of funding was no longer an allowed excuse for noncompliance. Plants were warned to meet regulations without federal funding or face enforcement. But much damage resulted from the previous connection between compliance and funding. Plant owners and operators were constantly reminded of the connection. Congress and the EPA, through the massive outlay of funding, lax enforcement, and repeated deadline delays impressed local officials with three themes:

1. The outlay of free money was an admission by Congress that it was the federal government's responsibility to construct wastewater treatment plants.
2. Deadline delays indicated that local governments would not be penalized for the federal government's failure to provide enough money or the EPA's failure to provide enough guidance.
3. Lax enforcement clearly demonstrated that compliance was not important enough for the EPA to justify enough time and manpower to seek out those plants who were not complying.

The established connection between funding and compliance hindered the goals of the CGP. Rather than encourage compliance through federal funding, it created perverse incentives that made it advantageous in the eyes of owners and operators *not* to comply or even attempt to improve performance.

Congress and the EPA intended the CGP to be a temporary form of assistance designed to encourage compliance, not a perpetual source of funds for wastewater treatment plant construction. That the CGP was not intended to be a continuous source of money was clearly stated to all participants from the very beginning of the program. In 1987, President Ronald Reagan attempted to block passage of the 1987 CWA amendments. His veto message, addressed to the House of Representatives, stated his reasons for objecting to continued CGP funding:

The Clean Water Act construction grant program, which this legislation funds, is a classic example of how well-intentioned, short-term programs balloon into open-ended, long-term commitments costing billions of dollars more than anticipated or needed. Since 1972, the Federal Government has helped fund the construction of local sewage treatment facilities. This is a matter that historically and properly was the responsibility of State and local governments. The Federal Government's first spending in this area was intended to be a short-term effort to assist in financing the backlog of facilities needed at the time to meet the original Clean Water Act requirements.

B. Operator Knowledge and Training

In conjunction with the CGP, the EPA worked closely with local officials and states agencies to ensure that communities had the technical expertise to operate their wastewater plant. The EPA-funded CCP study revealed that compliance is best promoted when regulators enforce performance standards and abstain from recommending particular compliance methods. When local officials followed regulatory

technical advice, they believed "that they were meeting state requirements whether or not compliance was achieved." However, specific recommendations provided by the EPA or state agencies were not always correct and did not always result in compliance or improved effluent quality. As the CCP study consultants observed:

An aspect of regulatory agency activity that confused owners and redirected their activities away from achieving required effluent quality was that of providing specific operations or maintenance recommendations. Owners often religiously carried out these recommendations and were subsequently confused and frustrated when they found that they were facing still more requirements when compliance was not achieved. Additionally, assistance was perceived by the facility owners as a relief from local responsibility for effluent compliance.

The EPA's technical assistance and operator-training programs are designed to "protect the Federal investment in municipal treatment facilities by developing a national base of skilled water pollution control personnel and technical information materials." The Water Quality Improvement Act of 1970 provided financial support for an EPA pilot-operator training program. Working with states, local communities, educational institutions, and trade associations, the EPA provided a wide range of training programs including management training, advanced treatment training, general skills workshops, informational seminars for local officials, correspondence study programs, and preventive maintenance training. As the goal was development of self-sufficient operator-training programs, the EPA recommended provision of "onsite, over-the-shoulder technical assistance...by experienced operations and maintenance personnel, preferably State employees." State use of "contract assistance approaches (was) discouraged," instead the EPA promoted self-sufficiency through "State hiring of qualified technical assistance personnel in State training centers or other responsible State program offices."

The CCP study determined that many local plant operators did not place an adequate emphasis on operator knowledge and training, due in part, to local authorities and plant operators not realizing the potential impact of operator actions on plant performance. Evident in the corrective recommendations issued by the study was the belief that operator education would receive more emphasis if its importance were recognized. However, local participation in the CCP study was not mandatory. Local officials or operators who had reasons not to seek improvements at their plant would have reasons not to participate. The consultants noted that "reluctance to invest or focus their attention toward existing facilities pending the availability of construction grant funds was a key" reason why some municipalities refused to participate. One official stated that "at this time it would be senseless to spend additional money on our present sewer treatment plant. Our plant is inadequate and has never functioned properly." Even the possibility of future grant funding discouraged plant operators and local officials from improving operator training or plant performance.

EPA advice is not limited to the operation and maintenance of existing plants. Local officials in Garland, Texas, accepted the EPA's recommendation of an innovative technology. Under the CGP, certain innovative or alternative technologies received increased grants relative to conventional treatment methods. Garland took the extra funding and built a \$30-million physical-chemical treatment plant. Seventeen days after startup the plant failed. William E. Dollar, Garland's Director of Public Works, claims that "because this was such a new process, we depended on ... the EPA to let us know" about the plant. Initially, the EPA provided glowing recommendations about the technology. After it failed, the EPA sued Garland for failure to meet discharge permits. Garland sued engineers involved with the project and again asked the EPA for help. Dollar claims the town spent "almost a year in numerous meetings trying to get clear directions from the EPA." Eventually, Garland was forced to

seek the help of an engineering consulting firm. Again, it appears that federal money, in this case funding for innovative or alternative technology, discouraged local accountability.

Like federal funds through the CGP, technical advice was provided by the EPA to foster compliance and local self-sufficient wastewater treatment programs. But, also like federal funding, federal technical assistance encouraged states and communities to view wastewater treatment as a federal responsibility. In an environment of free technical advice, lax enforcement and unclear assignments of responsibility, communities had little incentive to develop self-sufficient technical capabilities.

C. Design, Construction, and Maintenance

The CCP study revealed numerous design, construction, and maintenance problems present in federally funded facilities. The extent of design failure was particularly surprising given that plants with obvious design flaws were excluded from study. Design improvement and increased flexibility and controllability of equipment were the two physical plant recommendations resulting from the CCP study.

Under the CGP, wastewater treatment plants were designed for a 20-year life. As a result, treatment requirements needed 20 years after the start-up of the plant had to be estimated before design or construction began. Although lack of accurate knowledge about future treatment needs would seem to have encouraged flexible designs to accommodate unpredicted changes, this did not appear to happen. As a result, plants ten years into operation may be restricted by equipment designed on the basis of an inaccurate future-needs prediction which did not reflect the current demands on the plant.

CGP regulations required EPA or state-agency approval of all design changes and construction upgrades of federally funded plants. The process of receiving design and construction approval from the EPA was a long and complicated process. Review of the three-step grant application added as much as six years to the construction process with an average delay of two to four years. In addition, some communities waited on state priority lists for ten years before receiving notification of grant eligibility. The enormous demand for grants, combined with lengthy regulatory reviews, hindered the EPA's ability to provide more frequent design reviews.

The EPA's 1982 *Handbook: Identification and Correction of Typical Design Deficiencies at Municipal Wastewater Treatment Facilities*, identifies many of the problems relating to restricted operation or lack of flexibility. The handbook's intent is to provide "design engineers with guidance that will make their designs more operable and maintainable at less cost, as well as more flexible in providing adequate performance." The introduction to the handbook states that design deficiencies contribute to "decreased flexibility of plant process control." Design flaws addressed in the handbook that relate to the lack of flexibility include:

- inadequate process and operation flexibility;
- inadequate consideration of seasonal impacts on operating efficiency;
- inadequate estimation of present and future flows;
- inability to adjust and control process equipment in response to changes in waste characteristics; and
- inadequate consideration of maintenance needs including:
 - lack of provision for by-passing flow;

- inability to dewater tanks for repair; and
- lack of back-up unit.

The handbook also identifies the problems resulting from 20- to 30- year design lives. In many cases, the predicted design flow or treatment capability was based on inaccurate data. Numerous problems have resulted from errors of basing design on average flow and loadings (rather than peak), as well as failing to recognize the connection between treatment ability and seasonal influences when designing outdoor lagoons.

A 1980 GAO report stated that *"accountability under EPA's construction grants program is complicated by the many parties involved in the design and construction of a treatment plant: EPA regional officials, state regulatory agencies, municipal officials (the grantee), design engineering firms, industrial contributors, and finally, construction contractors and sub-contractors."* The report concluded that clear assignments of accountability would improve performance without the need for additional federal funding.

At the time the GAO report was published, the CWA placed responsibility for proper plant performance on local officials. However, local governments were prohibited from implementing design plans which did not meet the approval of state and EPA officials. When plants failed to meet design expectations, local officials blamed inadequate state and federal reviews. State and federal officials claimed that their review of design plans was never intended to thoroughly evaluate the design's ability to provide proper wastewater treatment.

Design and construction of wastewater treatment plants under the CGP was hindered by an inability to identify and hold accountable those responsible for the provision of inaccurate or improper design advice. As a result, construction and design was a lengthy and complicated process which frequently resulted in construction of improperly designed plants that were incapable of producing effluent in compliance with NPDES effluent permits. The same problems existed in relation to the provision of technical training and O&M advice. As a result, plant operators could not guarantee the accuracy of advice provided by regulatory agencies, local officials or private parties.

The inability to identify and hold accountable those responsible for provision of inaccurate or improper advice was compounded by the availability of extensive federal subsidies for construction costs and training programs as well as the failure of regulatory agencies to enforce NPDES effluent permits. As local governments were financially responsible for only a fraction of the construction and training assistance, they had little incentive to ensure the efficient expenditure of wastewater funds. In addition, as local governments were rarely held accountable for poor plant performance, they had little incentive to expend local resources to improve the accuracy of available advice or seek new sources of information.

In sum, the failure of the CGP to encourage self-sufficient local government wastewater treatment programs resulted from two factors. First, the CGP process was marked by an inability to identify and hold accountable those responsible for the provision of inaccurate or improper design, construction or operation advice. Second, the CGP failed to provide incentives for local communities to pursue efficient wastewater treatment plant construction and operation. Over time, recognition of these problems in an environment of decreasing federal funding and increasing treatment needs led Congress, the EPA, and local governments to seek new ways of providing municipal wastewater treatment.

V. ALTERNATIVE SOURCES OF FUNDING

A. State Revolving Funds

Title VI of the 1987 Water Quality Act introduced the State Revolving Fund Capitalization Grant Program (SRFCGP) designed to gradually convert wastewater treatment plant funding from federal grants to state loans. While the act extended the grant program, by authorizing EPA allocation of construction grants until 1990, it also set forth a schedule for ending all forms of direct federal funding by the end of fiscal 1994. By that time, states are expected to have self-sufficient wastewater treatment programs.

Congress recognized that the transition to state responsibility would be difficult as states were accustomed to decades of federal support (as well as prior federal attempts at developing "self-sufficient" state programs). Therefore, Congress encouraged states to develop self-sufficient funding programs by authorizing federal capitalization grants for approved State Revolving Funds (SRFs). In order to qualify for capitalization grants, states are required to provide a 20 percent match to the federal share and authorized to reserve 4 percent of grant funds for administrative costs. In addition, states must establish an EPA-approved state environmental review program (SERP) and all SRF-funded projects must undergo SERP reviews.

To establish a SRF, a state must submit an application form which includes a description of the SRF structure and an Intended Use Plan (IUP) which specifies how the state will use grant funds to help local governments meet the requirements of the Clean Water Act. Each year thereafter, the state must submit an updated IUP and an annual report. These reports detail the state's efforts to comply with SRF administrative requirements such as federal accounting and auditing procedures and ensure that projects funded by SRF funds have complied with at least 46 different federal regulations including 16 different "Title II" requirements carried over from the CGP that specifically address wastewater treatment, as well as at least 30 different federal laws and executive orders attached to federal funding. Title II requirements apply only to projects funded by the federal capitalization grant, not to projects funded by state matching funds or funds resulting from repayment of earlier SRF loans.

Unlike the CGP, states are primarily responsible for ensuring that communities adhere to funding regulations. Rather than directly review individual projects, the EPA will oversee compliance with funding regulations through its review of state annual reports. If the EPA's Office of Inspector General determines that a state has not administered the SRF in compliance with federal standards, federal capitalization grants to the state's SRF will be suspended. If the state fails to take corrective action, the capitalization grants will be awarded to another state.

Funds from a qualifying SRF must be loaned to communities at or below market interest rates. Negative interest and grants are prohibited. While SRFs can be used to fund pollution control projects other than wastewater treatment, states must ensure that funds are first directed toward facilities not yet in compliance with the Clean Water Act. After complying with this "first use" requirement, states can assist development of other water pollution control projects such as prevention of nonpoint source or estuary pollution. All states have met first use requirements.

As the SRFCGP converts federal grants to loans which must be repaid, local officials are encouraged to provide the best treatment at the least cost and avoid unnecessary "gold-plated" features. The SRFCGP also increases the flexibility of wastewater treatment funding by allowing SRFs to be used to provide guarantees for local loans, to purchase municipal bond insurance, or to refinance existing local government wastewater treatment debt obligations. In addition, by providing a renewable source of

wastewater treatment funding, Congress has attempted to end continued state and local government reliance on federal funds and finally establish self-sufficient treatment programs.

Detailed information on the ability of SRFs to finance efficient wastewater treatment is not yet available. However, initial findings indicate that the need to repay loans is resulting in construction of more appropriate and efficient wastewater treatment facilities. State officials expect SRF financing to result in construction of lower-cost facilities.

Although the SRF appears to be an improvement over the CGP, numerous aspects of the SRF still inhibit efficient investment in municipal wastewater treatment plants capable of meeting effluent standards. States claim current program regulations hinder the ability of communities to finance appropriate wastewater treatment methods. SRF loans can only be used to purchase land if the land itself is part of the treatment process. Thus, communities may receive assistance for the acquisition of land for development of wetland filtration projects but not for treatment plants or easements for sewer collection systems. The EPA included land purchase restrictions in the CGP to prevent the purchase of unnecessary land which could later be used for other purposes. Forty-two states responding to a 1992 GAO SRF survey reported that land restrictions should be waived. According to an official in charge of Florida's program, the cost of land for unsewered communities can represent about 20 percent of the project's cost. The GAO noted that states were capable of determining necessary land requirements and concluded "that an across-the-board restriction on the eligibility of land purchases for SRF assistance is counterproductive for many local governments."

The GAO also criticized SRFCGP restrictions which limit loan terms to 20 years and EPA's failure to provide knowledgeable EPA staff to assist states in development of SRFs. Currently, communities receive 20-year loan terms regardless of the design life of the facility. As a result, some communities may find it difficult to finance facilities with longer design lives while others may find that loan repayments extending beyond the design life hinder the ability to upgrade a previously financed plant. The GAO recommended matching loan terms to the estimated design life of the facility. The GAO also concluded that states lack the expertise to manage SRFs and suggested that the EPA, through additional training and hiring of EPA regional staff, increase state technical and administrative assistance. Such recommendations are likely to discourage states from accepting responsibility for SRF administration.

The SRFCGP also restricts a community's ability to provide the most appropriate treatment method for its needs. For example, SRF loans cannot be used to finance the portion of a wastewater treatment facility owned by the private sector. In addition, Congress continues to restrict the flexibility of the treatment selection process through the carry-over of numerous CGP "Title II" provisions which include requirements that local governments select treatment technologies meeting EPA approval. Communities must also demonstrate consideration of innovative or alternative treatment methods for projects funded from funds equivalent to those granted by the federal capitalization funds.

In summary, the disadvantages of the SRFCGP result from the ways in which it resembles the CGP and discourages local governments from developing self-sufficient wastewater treatment programs. This effect results from the continued federal regulation of the wastewater funding process administered by the states and of the treatment selection process undertaken by local governments. According to the Water Pollution Control Federation Executive Committee, "administrative burdens imposed by the Federal government upon obtaining revolving loan funds...add unnecessarily to facility costs, discourage use of these funds by smaller municipalities, delay the construction of facilities, and reduce states' flexibility to allocate loan funds according to their own priorities."

B. Privatization

Public-Private Partnerships. As a result of the cumbersome requirements of federal funding, decreased funding, stricter wastewater regulations, and decaying infrastructure, many local and state governments have turned to various forms of privatization or public-private partnerships to solve their wastewater treatment problems. Studies investigating capital-intensive services, such as wastewater treatment, have revealed that economics, either the lack of eligibility for a federal grant or the high cost of running a plant, is commonly cited as the number one reason for considering private-sector involvement. However, communities that have increased the private sector's role in either the production or provision of wastewater treatment have found that economics is not the only factor to consider. The EPA lists five "basic reasons" for communities to consider public-private partnerships.

1. Access to more sophisticated technology;
2. Cost-effective design, construction and/or operation;
3. Flexible financing, including the use of private capital;
4. Delegation of responsibility and risk; and
5. Guaranteed cost.

Even during the height of the construction grants program, some communities elected to forgo federal funding and use their own funds to meet their treatment needs. In his 1986 article, "Facing the Challenge," EPA Assistant Administrator of Water Lawrence Jensen described the effects of the CGP program:

Federal dominance inadvertently fostered an atmosphere of passive dependency. Action on existing needs and planning for future growth was thwarted as some municipalities stood in the federal waiting line. Conversely, many communities were not interested in this waiting game and proceeded to find suitable financing solutions on their own. These communities overcame obstacles and realized substantial benefits as they proceeded, thus making the grants trade-off worthwhile. Some notable advantages include cheaper and more efficient construction, ability to select local design preferences, greater responsiveness to economic growth, fewer procedural requirements, enhanced flexibility to address future changes, and greater certainty as to the timing of services to customers.

A 1989 study of wastewater treatment privatization conducted by Laurence J. O'Toole documented some of the beneficial effects of greater private-sector participation:

Privatized design and construction of wastewater treatment facilities proceeded more smoothly, as perceived by participants, and much more quickly (by more than two years, on average) than in the grant-funded setting. Furthermore,...output measures of effluent quality and of compliance with regulatory standards showed that privatized facilities do not suffer by comparison with...counterparts.

Private involvement in the provision of wastewater treatment can take several different forms. Table 2 displays the most common variations of public-private partnerships. Represented are six aspects of wastewater treatment that can be the responsibility of either the public sector, or the private sector. The six aspects together encompass the entire production and provision of wastewater treatment. The public-private continuum displays the strictly public involvement of traditional treatment on the left side, and the entirely private involvement of a merchant facility on the right. At least four

combinations of public-private involvement make up the continuum between these two extremes. Not all partnerships follow these strict assignments of public or private responsibility. The wide variety of approaches allows public-private partnerships to be tailored to the specific needs of the municipality and the capability of the private sector.

Municipal wastewater treatment facilities have been constructed under each of the six different combinations of public-private partnerships displayed. The most common choices, excluding the traditional public-only model, are contract services and turnkey facilities. Privatization and merchant facilities are much less common after the Tax Reform Act of 1986, which reduced the tax incentives for private ownership. Frequently, developer financing results from a community's need to accommodate growth. Merchant facilities are characterized by full private-sector control of all service aspects, including the initial decision to provide. Merchant facility provision of wastewater treatment is not common but may be more prevalent in the future as private firms offer to provide treatment plants to small unsewered communities or to communities that cannot afford to upgrade or replace their current plant.

Contract Services. The most common form of wastewater privatization is a contract under which a private firm takes responsibility for the day-to-day operation and maintenance of a publicly owned plant. The O&M contract signed between Leominster, Massachusetts, and Wheelabrator EOS illustrates several advantages of contracting out. As with all forms of private involvement, this contract was unique, but as studies have indicated, other municipalities have benefitted from contracts containing some of the key features.

Leominster, a city of 35,000 people, completed construction of a new plant in 1983. The new \$23-million plant was financed through the CGP, with the city contributing less than \$3 million of the construction costs. Leominster sought an O&M contract for the new plant for two reasons. The new plant was an Advanced Wastewater Treatment (AWT) plant whose operation and maintenance would require more money and highly-trained personnel than were available. The new sophisticated technology of the AWT plant was needed to remove phosphorus and ammonia but was expected to require \$1.2 million in O&M costs every year—a substantial increase over the previous \$450,000 per year required for the older plant.

Leominster contracted with Wheelabrator EOS to ensure that the plant was adequately operated and maintained for less than \$800,000 per year (for a cost savings of about 30 percent). Wheelabrator offered jobs to all seven of the plant's existing employees and provided a manager, selected in part by the town. As part of the operating agreement, Wheelabrator provided a performance guarantee and liability insurance. For the initial six months of the contract, the firm provided 15 specialists to evaluate and improve not only maintenance and operation, but also nontechnical areas such as employee and community relations, administration, and accounting.

The biggest change for employees was the installation of an automatic dialing alarm system, which Wheelabrator EOS used at several plants. The system automatically dials a technical assistance hotline when a treatment malfunction occurs. An electronic voice informs the operator of the location and type of problem. Leominster has discovered that the automatic alarm system is more reliable than a single manned operation. The plant met effluent quality requirements within three days of start-up. Technical expertise provided by Wheelabrator saved Leominster an estimated \$400,000 per year.

Contract operations illustrate several advantages of private-sector involvement. Many communities like Leominster are unable to provide the technological expertise necessary to operate a treatment plant. In some cases, political or financial pressures prevent a community from hiring the necessary

personnel as the salary of a qualified operator may exceed that of the local mayor. Private provision of O&M, however, can be attractive even to those communities able to afford the expense of an operator.

Unlike an individual community, private contract firms such as Wheelabrator EOS are able to take advantage of economies of scale—cost savings from large-scale production. Thus, Wheelabrator could lower Leominster's O&M costs by providing a centralized alarm system, the cost of which is shared by other Wheelabrator clients. Such economies of scale also extend to bulk purchasing of treatment chemicals and emergency pumps or other specialized equipment and personnel that can be transported to a site as needed.

Municipal operation of wastewater treatment is also hindered by unclear assignments of responsibility and accountability. In an environment of public operation, political power struggles have resulted in continued noncompliance while various levels and departments of local government argue over the relative importance of wastewater treatment and the best methods of ensuring proper operation. Under a service contract, a private firm usually takes responsibility for compliance with NPDES discharge permits. The contract can ensure that the private sector is held accountable for noncompliance by requiring payment of EPA enforcement actions. In addition, the daily responsibilities for payroll, insurance, maintenance, and regulatory reporting are transferred to the private firm and accountability for these issues is guaranteed through contract. The private firm has experience at addressing these issues as they relate to wastewater treatment and, unlike municipal operators, it is free to make adjustments in daily operation without waiting to first obtain permission for the changes from the local government.

Accountability provided in the contract ensures that a private operator will either meet the contract standards established by the local government or face penalties such as fines or contract termination. Furthermore, a private firm has an incentive not only to meet the standards established by the contract, but to exceed them. If a private firm fails to operate and maintain a plant in the most efficient, low cost manner, it may lose its contract to a firm that can. Unlike municipal operation, contract service is not a monopoly. Competition from other contract firms serves as a constant incentive to improve performance.

Turnkey Facilities. The turnkey approach takes private involvement two steps beyond contracting out and places design and construction responsibilities in the hands of the private sector. As noted in the CCP study, even the best operation and maintenance services cannot overcome poor design or construction defects. Placing responsibility for design and construction with the same party responsible for operation and maintenance ensures a coordinated approach. Under the construction grants program, it was difficult to hold anyone responsible for poor design or construction defects. In addition, as few incentives for proper operation and maintenance existed and poor performance was rarely punished, the extent of design and construction defects frequently remained hidden.

The CCP study, which focused on operation and maintenance improvement techniques, deliberately excluded plants with obvious design or construction defects. Nonetheless, the study that latent design defects "were severely limiting the operator's ability to achieve maximum performance from the facility." Under a turnkey contract, a private firm designs, builds, and operates a wastewater treatment plant, but the ownership remains public. The coordination of design, construction, operation, and maintenance forces the private contractor to consider the relationship between individual steps. Accountability provided under contract, and competition from other firms, ensures that the contractor will not make sacrifices in one area if they increase costs or place an unacceptable burden on another.

Casa Grande, Arizona chose a turnkey approach to upgrade its wastewater treatment system for the sole purpose of providing higher-quality effluent for irrigation. The city relied on an aerated lagoon and stabilization ponds for wastewater treatment. Its effluent was meeting standards, and the lagoon had enough reserve capacity to serve the area for many additional years. However, the town had only a nine-hole golf course and wanted 18 holes. Lack of state-approved irrigation-quality water prevented golf course expansion.

Engineering Science, Inc. (ES) and its sister company, Parsons Environmental Service (PES), worked together to design, construct, and operate the new facility. Unlike Leominster, Massachusetts, PES wrote specific O&M manuals and trained city employees to operate the new system but did not take over the daily O&M responsibilities. The new facility was not significantly more difficult for city employees to operate, and PES's only continuing responsibility for O&M is the provision of on-call laboratory analysis and operational support when needed.

Casa Grande's turnkey contract required that the plant's upgrade be compatible with future plant expansions. ES constructed an upgrade that could be operated in parallel with future upgrades and provided extra capacity in two of the capital-intensive areas, the chlorine and chemical buildings. As a result, Casa Grande obtained a wastewater treatment system that could change with the city's needs. The use of such modular designs may reduce construction costs by as much as 25 percent. By contrast, CGP-funded plants were frequently inflexible and therefore difficult to adapt to communities' changing needs because of grant funding which encouraged over-design and construction.

A significant advantage of turnkey contracts is the ability of design and construction engineers to coordinate the design, material procurement, and construction phases. Such coordination provides more flexibility in the construction process and allows designers and construction engineers to devote more attention to the possible use of innovative design or construction techniques. Under the CGP, design is primarily controlled by design engineers with little input from the contractor. Coordination of the process, achieved by the turnkey approach, minimizes change orders and reduces friction. For Casa Grande, such coordination provided significant savings:

The turnkey approach saved eight weeks in the bidding/award/mobilization process alone. Additional savings to the tight construction schedule were realized when the equipment procurement process began at the 50- percent design level... The turnkey approach also eliminated delays during construction by putting the engineering and construction staff in a single trailer at the site, thereby trimming communications time and reducing delays due to submittal preparation, transmittal, and review.

Developer Financing. Developer financing places another aspect of wastewater treatment plant construction in the hands of the private sector, although developer responsibility for finance is not always accompanied by developer responsibility for design, construction or maintenance. In its most common forms, developer financing is characterized by private-sector design and construction of a wastewater facility that is turned over to the local government when completed or developer assistance provided directly to the local government for construction of wastewater treatment.

Developer financing is a way of "requiring growth to pay its own way." Given that new communities generally do not have a tax base to finance the construction of public facilities such as wastewater treatment plants and schools, developers are encouraged to participate in financing public projects. In some areas, such as Escondido, California, financial contributions to construction of a wastewater facility have been required in exchange for permission to develop or the right to reserve a portion of future sewer capacity.

The city of Escondido faced three problems. The current wastewater treatment plant was operating at capacity and the city was growing. Furthermore, the city faced enforcement from the state for poor plant operation and a lawsuit from a neighboring town for failure to fulfill a sewer service contract. Escondido needed an upgraded plant, increased sewer capacity and relief from the enforcement efforts and lawsuit.

As a result of several voter referenda, Escondido was prohibited from using bond financing, user fees or other forms of financing to upgrade their plant. By selling the rights to future sewer capacity to developers and citizens before the capacity was available, Escondido financed the entire cost of the plant upgrade and sewer capacity expansion and actually had funds remaining for future needs.

In return for the needed access rights to the sewers, developers and individual citizens paid for contracts with the city that designated the amount of capacity purchased. Initially, access rights were sold for \$1,650 per "equivalent dwelling unit" (EDU). One EDU is the equivalent of 270 gallons per day, which is the estimated amount required for a family of four. Seven years later the price of one EDU had risen to \$3,300.

In this arrangement, the city of Escondido was responsible for individual contracts and required all people seeking access to the sewers to purchase a contract with the city. The first purchasers who bought rights before the plant was built received exemption from future increases of connection fees as an incentive to help finance the plant. Escondido also signed a contract with the neighboring city of San Diego to provide additional sewage treatment. Private-sector involvement was limited to the purchase of access rights that financed the entire project.

Full Privatization. While all forms of public-private partnerships can be described as forms of privatization, full privatization has its own unique meaning. When a facility is described as fully privatized, the responsibility for the design, construction, financing, ownership, and O&M rests entirely with the private sector. The popularity of full privatization decreased due to the changes in tax laws in the mid 1980s. These changes made private ownership much less attractive and hindered the ability of communities to issue tax-exempt bonds to finance privatized facilities.

The 1986 Tax Reform Act eliminated or reduced several incentives for private investment in wastewater treatment facilities. Previously, private investors received a 10-percent Investment Tax Credit for the purchase of certain types of depreciable property. For a typical wastewater treatment plant, this credit applied to 80 to 90 percent of the total cost. The 1986 act also lengthened depreciation schedules. Depreciation allows an investor to recognize the declining value of an asset as it ages by writing off a percentage of the asset's cost each year of the asset's life. The 1981 Accelerated Cost Recovery System encouraged investment by allowing investors to depreciate an asset over a time period shorter than its useful life. For wastewater treatment plants, 80 to 90 percent of assets qualified for 5-year depreciation schedules. By lengthening the depreciation period of treatment plants from five to 15 years, the 1986 act reduced the amount of cash available to support an investment in its early years.

Tax reform also hindered the ability of local governments to issue tax-exempt bonds to finance wastewater treatment. Until 1968, all income received by investors from state or local bonds was tax-exempt. The Revenue and Tax Expenditure Control Act of 1968 eliminated the exemption for most bonds if more than 25 percent of the bond proceeds were used by a "nongovernmental" entity in a trade or business and bond repayment for more than 25 percent of the bonds was guaranteed by property taxes or revenues generated by the business. Bonds used to finance projects failing either test were tax-exempt. Bonds passing both tests were defined as taxable Industrial Development Bonds (IDBs).

Exemptions from these two tests, known as the "use of proceeds" and "security interest" tests, were granted for numerous projects, including wastewater treatment.

In 1986, the Tax Reform Act redefined IDBs as Public Activity Bonds (PABs) and reduced the percentages of the "use of proceeds" and "security interest" tests to 10 percent. For example, even a *publicly* owned wastewater treatment plant serving industrial users under a contract that differs from the contract provided to the general public can end up in the PAB category if the industrial use exceeds 10 percent of the plant's capacity. Wastewater plants operated under contract operations by the private sector will also be classified as PAB projects unless the contract life is limited to no more than five years, the private operator's compensation is not based on profit sharing, and the local government has the option of terminating the contract at the end of three years without penalty.

Although the 1986 act retained the previous tax exemption for wastewater treatment plants, such projects must comply with state volume caps which limit the amount of PABs that a state may issue to the equivalent of \$50 per resident, with a minimum of \$150 million allocated to each state. Unlike airports and docks, which are excluded from volume caps, wastewater treatment facilities must compete with other projects such as multifamily housing and student loans for the limited amount of tax-exempt financing available under the cap.

In a report prepared for the EPA's Office of Wastewater Enforcement and Compliance, James N. Smith and Mary S. Lyman argue that restrictions on private wastewater treatment contracts by the 1986 Tax Reform Act may "prevent the parties involved from negotiating a contract which is more cost effective for the local government." As a result of these tax-law changes, private involvement since 1986 more often takes the form of a turnkey agreement with a private O&M contract.

Several proposals have been made to modify or reclassify bond legislation to provide communities with greater flexibility. The Anthony Commission, established by Rep. Beryl Anthony in 1988 to study the effects of the 1986 Tax Reform Act on the municipal bond market, has recommended the creation of tax-exempt "public-activity" bonds that could be used to finance privately owned and operated wastewater plants. The Commission's current proposals extend the allowable operation contract length from five years to the facility's economically useful life, but prevents private owners or operators from taking any cost recovery deductions. In 1991, Senator Pete Domenici introduced legislation to create "infrastructure bonds" for environmental infrastructure projects that would exempt such projects from volume caps and allow accelerated depreciation. EPA's Environmental Financial Advisory Board recommended a similar approach for environmental facilities mandated by federal law.

In November 1993, legislation to remove an impediment to private investment in municipal wastewater treatment plants was introduced by Senator Frank Lautenberg (D-NJ). S. 1681 "would amend the Federal Water Pollution Control Act to allow certain privately owned public treatment works to be treated as publicly owned treatment works...." Because privately owned treatment works generally must meet more onerous treatment requirements, by providing uniform regulatory treatment, the act will help attract private investment to municipal facilities.

Two privatized wastewater treatment plants built before the tax-law change are located in Auburn, Alabama. Auburn was low on the state list to receive funding through the CGP even though both of the city's wastewater treatment plants were operating at capacity and were having trouble maintaining effluent quality. Auburn is typical of many towns in that it waited years to receive federal money, only to find that it had to build plants without federal assistance. After 12 years of waiting for the federal grant, Auburn finally decided to investigate the privatization option to finance two new plants with

specially issued bonds. The engineering and consulting firm of Metcalf & Eddy (M&E) was hired to design, construct, operate, and own the new plants. Although M&E was not solely responsible for the financing, it did contribute \$10 million in equity to reduce outstanding debt and debt-service payments. In return for its involvement, M&E received the benefits of the favorable tax laws and the city's previous wastewater employees were all trained and offered positions in the new plants. The city expects to save \$25 million over the life of the 25-year contract.

In 1993, the EPA selected wastewater treatment plants in three cities as pilot projects to test privatization under Executive Order 12803. The April 1992 order establishes federal policy in favor of requests by state and municipal governments to sell or lease infrastructure enterprises that have received federal grants, explicitly including wastewater treatment plants. By allowing local governments to reimburse the federal treasury for only the undepreciated portion of federal grant financing, and not the entire amount, the order removes an important impediment to privatization.

Wheelabrator EOS has offered to buy one of the pilot projects, the Franklin (Ohio) Area Wastewater Treatment Plant. Under a 20-year service agreement, the firm would maintain constant inflation-adjusted rates and charge a negotiated fee to the municipality, which would collect customer fees. The "original cost less depreciation" value for the plant is \$6.8 million, which is close to the "transfer price" of \$6.1 million that Wheelabrator will have to pay to service the 4-mgd plant's debt and cap the rates at their present levels. The transfer is expected to be completed by mid-Summer 1994.

Privatization and Performance. The various benefits of privatization result from the clear identification of responsibility and accountability, which accompanies private-sector involvement, and from incentives, naturally arising in a competitive environment, that encourage efficient construction and operation. *Clear assignments of responsibility are linked to accountability through a privatization contract.* In an extensive study of capital-intensive privatization, John G. Heilman and Gerald W. Johnson concluded that privatization shifts "[a]ccountability mechanisms...from traditional local political processes to the contract and to the ongoing partnership between the privatizer and the authority." This transfer from the political process to the contractual setting places the provision of wastewater treatment in a competitive environment where private firms continuously compete to be the best provider of a community's needs. It also removes the day-to-day responsibility for protection of the community's wastewater needs from public officials and places it with the private sector, where it is protected by a partnership contract and legal enforcement.

Under a proper privatization contract for design, construction, operation or maintenance, the responsibilities of both parties are clearly defined. The municipality knows what it can expect from the private firm and the private firm knows what it must do to fulfill the contract. In addition to responding to the threat of legal action such as contract termination or financial penalties for poor performance, the private sector must also respond to financial constraints. Not only does the private firm realize that lack of funding will not be an acceptable excuse for noncompliance, but the private firm has an incentive to perform the service at the least possible cost while still meeting the terms of the contract. If a firm fails to operate an efficient plant, it may lose its business to one that does.

Clear assignments of responsibility, combined with proper accountability, can ensure that incentives exist for proper performance. In the federal-funding environment, incentives exist which encourage noncompliance. These incentives encouraged pursuit of lower local O&M expenditures, federal grant funds, and new MWTPs for the purpose of improving local economic conditions. As local governments were not held accountable for improperly designed plants, there were few incentives to seek proper performance and compliance with NPDES effluent permits. If it is not possible to identify

and hold accountable those responsible for poor compliance, such incentives will remain a tempting course of action for local governments.

Privatization also provides incentives which encourage the constant pursuit of improved wastewater treatment technology. Economist John Donahue has noted that the benefits of innovation are not only related to improved responsibility and accountability for risks and profits. The private sector can also benefit through the avoidance of public-sector limitations that prevent local municipalities from reaping the benefits of new technology.

*For a municipal agency, the potential **payoff** for innovation is limited to whatever lower costs or higher quality can be achieved within the city limits. Except in the biggest cities, it seldom makes sense for public works departments to make large investments in innovation. A private contractor, however, can claim proprietary rights to innovations, diffuse new methods through its operations, and use technological advances as a competitive edge to expand its market.*

Privatization provides a strong incentive for firms to develop improved treatment technologies and operation methods for the firm that does not constantly struggle to improve will be forced out of the market by others pursuing improvements for their own benefit. Thus, privatization captures the benefits produced by competition and provides these benefits to the local government which remains protected from the risks of research and development by the privatization contract.

Avoidance of costly regulations and restrictions that accompany private involvement in wastewater treatment provision fosters another benefit. Removing many of the federal restrictions governing wastewater treatment construction places the municipality and the private sector in a partnership where both sides seek similar goals. John G. Heilman and Gerald W. Johnson note that involvement of the EPA "introduces the at least partially competing values of the regulatory process." For example, competing values may encourage the EPA to "compensate" a community and its design engineers for regulatory burdens by approving expensive treatment plant designs. In addition, by fostering incentives that made it desirable not to comply with clean water regulations, the CGP discouraged local governments from improving wastewater treatment capacity and performance.

In the area of design and construction, the differences between competing goals and complementary goals is clear. O'Toole studied two plants in the same town, one CGP grant-funded and one privatized. He found that in a public setting, "designers tend to view change order requests as a challenge to the quality of the original design and thus seek to defend their turf." In comparing the contracting costs of two plants, O'Toole notes that "substantial transaction costs were accrued in negotiations with the grant-funded designer. However, in the privatized case, the builder and the designer had complementary incentives and early agreement was reached." Privatization also avoids the necessity of regulatory and municipal reviews of design changes. Such reviews are conducted to ensure that changes meet federal quality and funding eligibility requirements. In a grant-funded setting these reviews can take weeks or even months. Privatization avoids design change delays while shifting responsibility for quality assurance and cost control from the regulatory agency to contractual guarantees.

If the construction and the financing aspects of the partnership are not connected to federal funds, federal rules and regulations attached to grant funds can be avoided. When money was in grant form it was easier to comply with such standards since someone else was paying for the majority share. But now myriad regulations including bid procedures and pay scales significantly raise the cost of securing funding.

Restrictions that accompany federal funding include the Davis-Bacon wage act, which requires that all workers on federally funded projects receive the prevailing wage rates of the area. Laurence J. O'Toole notes that this policy reduces wage competition and drives up the cost of construction. As a result of protests by construction firms, the Department of Labor reduced prevailing wage rates in 1983. For one treatment plant bid alone, the estimated savings from reducing the wage rates by an average of 35 percent was \$300,000 to \$500,000 or almost 13 percent of total job costs.

VI. RECOMMENDATIONS FOR IMPROVING WASTEWATER TREATMENT PERFORMANCE THROUGH PRIVATIZATION

Privatization is characterized by clear assignments of responsibility and accountability. When these roles are clearly defined in the competitive privatization environment, proper design, construction, operation and maintenance of wastewater treatment facilities is constantly pursued. The privatization contract and the competitive nature of the privatization environment ensure that those responsible for inefficient provision of wastewater treatment will be held accountable for their actions. As a result, privatization offers benefits that cannot be captured by continued federal funding and regulation of the provision of wastewater treatment services. These benefits include the ability of privatized plants to provide contractual performance and cost guarantees, shorter construction times, more flexible treatment technology, and lower construction and operation costs.

Although the various forms of privatization have been pursued by hundreds of communities throughout the country, numerous factors restrict the ability of communities to fully capture the advantages provided by private-sector participation in the provision of wastewater treatment. By addressing some of these restrictions, the following recommendations would contribute to the development of cost-efficient, reliable municipal wastewater treatment plants.

A. Federal Support for Cost-Effective Wastewater Treatment Performance

- Federal capitalization of SRFs should be allowed to expire as scheduled in 1994. As long as the federal government continues to fund wastewater treatment, communities will have an incentive to view wastewater treatment as a federal responsibility. Such a perception discourages pursuit of self-sufficient local programs.
- Congress and the EPA should not attempt to regulate the way in which a state administers its SRF. By declaring that states are responsible for ensuring a community's compliance with federal regulations attached to SRF loans, Congress continues to blur the lines of responsibility and accountability as enforcement (a.k.a. accountability) for noncompliance will be directed at the community level. Furthermore, congressional and EPA oversight of SRF administration encourages states to view efficient SRF allocation as a federal responsibility just as direct federal funding for compliance encouraged communities to view proper performance as a federal responsibility. States should be responsible for SRF allocation and accountability for improper or inefficient SRF administration should be enforced by individual communities and constituents of state legislators.
- Federal regulations attached to SRF funding should be removed from both the initial loans of capitalization grant funds as well as future funds made available as earlier loans are repaid. It is essential that states and communities do not view SRF funding as federal assistance and are not hindered in their attempt to use funds efficiently.
- Communities should be free to sell federally funded treatment plants to private companies. Federal funds were provided to improve wastewater treatment performance. Proper privatization can

encourage that goal. The federal government should insist on the provision of effective and efficient wastewater treatment, not municipal ownership.

·Tax laws that discourage the use of tax-exempt bonds for privately owned facilities should be modified so that private and public investors in wastewater treatment compete on a level playing field.

·The EPA should continue to encourage privatization through its Partners Rebuilding America Program but refrain from issuing guidance that would discourage a community from taking responsibility for designing the best partnership to meet its needs.

B. State and Local Support for Cost-Effective Wastewater Treatment Performance

·States should not attach regulations or restrictions to SRF loans which would discourage communities from assuming responsibility for wastewater treatment. If the states administer the loans with the same cumbersome rules and regulations as the CGP and restrict a community's ability to select the best treatment methods for its needs, the communities will have an incentive to view wastewater treatment as a state responsibility. Thus, regulations such as the "mini" Davis-Bacon acts should be repealed as these wage laws increase costs and restrict competition for the provision of wastewater treatment services. In addition, states should not prevent communities from using loans to help finance a privately owned facility. States must remember that the goal of financial assistance is the encouragement of efficient provision of wastewater treatment to meet the goals of the Clean Water Act.

·States and local governments should conduct a thorough review of procurement laws. Contracts should be let and equipment purchased by competitive bid. However, contracts should not be awarded on the basis of low bid alone. Communities must be allowed to negotiate with individual bidders to ensure the best overall contract.

·Local governments must recognize the importance of developing a privatization contract that clearly establishes responsibility and accountability. For example, contracts should include provisions such as: insurance to cover bankruptcy and maintain service; the right of first refusal if the private firm wishes to sell; the terms under which the municipality can change the O&M provider; and the conditions under which O&M fees can be increased.

ABOUT THE AUTHOR

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Endnotes

1. U.S. Environmental Protection Agency, *Enforcement Four Year Strategic Plan: Enhanced Environmental Enforcement for the 1990s*, February, 1991, p. iii.
2. Jeff Robertson, "Municipal Compliance With the Clean Water Act," *West Virginia Law Review*, Vol. 90, 1987, p. 603.
3. Roger Truitt, "EPA's Carrot Turns Into a Big Stick," *WATER/Engineering & Management*, July 1989, p. 32.
4. U.S. EPA, *1992 Needs Survey Report to Congress*, September 1993, p. 1.
5. U.S. EPA, *Public Private Partnerships for Environmental Facilities: A Self-Help Guide for Local Governments*, May 1990, p. i.
6. William K. Reilly in the U.S. EPA, *Paying for Progress: Perspectives on Financing Environmental Protection*, Fall 1990, p. 6.
7. U.S. EPA, *Public-Private Partnership Case Studies: Profiles of Success in Providing Environmental Services*, September 1989, pp. 6–7.
8. Robert O. Lenna, Chairman of the legislative committee of the Council on Infrastructure Financing Authorities, in "Don't Return SRF Program to Grants System," *Public Finance/Washington Watch*, June 24, 1991, Vol. 5, No. 23, p. 1.
9. *Ibid*, p. 1.
10. The effectiveness of the Clean Water Act's standards and EPA's permitting process is frequently questioned. See Brian R. Marshall and James C. Lamb III, "Evolving Water Quality Regulations," *State Government*, Vol. 55, No. 4, 1982, pp. 122–125. ("Making the necessary changes in laws and regulations could provide more efficient water quality protection than building unnecessary additions to treatment plants, or by wasting funds and energy necessary to operate plants at levels unjustified by water quality requirements of receiving streams" (p. 125)), Ronald A. Chadderton, "An Alternative to Water Pollution Controls," *Water Resources Bulletin*, Vol. 24, No. 1, 1988, pp. 183–187. ("the lack of well-defined property rights [in water pollution] has allowed pollution to become a problem...promotion of private ownership would create the institutional setting for total water management which planners claim to want to see, without the burden of extensive bureaucratic management structures" (pp. 186–187)), and Roger E. Meiners and Bruce Yandle, "Constitutional Choice for the Control of Water Pollution," *Constitutional Political Economy*, Vol. 3, No. 3, 1992. ("Even though the common law is far from perfect, it is our guess, based on the developments in tort law, that common law would provide more environmental protection for water, and the rest of the environment, than has the regulatory process." (p. 378)).
11. Under the act, states with an approved managing agency are allowed to administer the NPDES.

12. In most cases, MWTP will be used in place of the traditional POTW (publicly owned treatment works), which is normally used to refer to municipal plants. MWTP is preferred to prevent encouraging the assumption that all municipal plants are or should be publicly owned. Ownership is only one aspect of a plant that may be publicly or privately controlled. For example, some public treatment works have experienced increased private involvement in the form of contracting out or turnkey arrangements. These and other forms of privatization will be discussed in section V.
13. "Survey Predicts 33 Percent Municipal Compliance with 1977 Deadline," *Journal WPCF*, Vol. 49, 1977, p. 360.
14. U.S. EPA, *Interim National Municipal Policy and Strategy For Construction Grants, NPDES Permits, and Enforcement Under the Clean Water Act*, September 1978, p. 1.
15. U.S. Government Accounting Office, *Wastewater Dischargers are not Complying with EPA Pollution Control Permits*, 1983, p. i.
16. Major municipal dischargers are defined by the EPA as those plants which serve populations of at least 10,000 people or treat over 1 million gallons per day (MGD). A minor discharger serves less than 10,000 people or treats less than 1 MGD. Of the 531 plants, 274 were municipal and 257 were industrial.
17. U.S. GAO (1983). p. 8.
18. U.S. GAO (1983), p. 7. EPA disagreed with the findings of the GAO's study and claimed that significant noncompliance rates were 7 to 12 percent lower than stated. Thus, even in the EPA's opinion, municipal noncompliance rates were at least 79 percent, with significant noncompliance rates as high as 62 percent. Lisette Chou and Karen B. Carter, "The Enforcement Dilemma," *Journal WPCF*, Vol. 56, 1984, p. 115.
19. "Cities Toe the Line on Wastewater Rules," *ENR*, Vol. 220, 1984, p. 19.
20. Roger Truitt, "Noncompliant POTWs Can Minimize Penalties With a Proactive Strategy," *WATER/Engineering & Management*, Vol. 135, 1988, p. 22.
21. U.S. EPA (February 1991), p. 31.
22. U.S. GAO, *State Revolving Funds Insufficient to Meet Wastewater Treatment Needs*, 1992, p. 42.
23. *Ibid*, p. 43.
24. *Ibid*, p. 42.
25. Chou and Carter (1984), p. 117.
26. NPDES permits are issued by 37 states. The EPA issues permits for the remaining 13 states.
27. U.S. GAO (1983), p. 35.
28. Personal communication with Danna McDonald, U.S. EPA, Office of Wastewater Enforcement and Compliance, October 1993.

29. U.S. GAO (1983), p. 16.
30. *Ibid*, pp. 17–18.
31. David J. Schaeffer and Harold W. Kerster, "Quality Control Approach to NPDES Compliance Determination," *Journal WPCF*, Vol. 60, 1988, p. 1436.
32. Federal Water Pollution Control Act, § 210.
33. Biological oxygen demand measures the amount of oxygen needed to remove organic material from wastewater. Both BOD and TSS are requirements stated in individual NPDES permits.
34. Walter G. Gilbert, "Relation of Operation and Maintenance to Treatment Plant Efficiency," *Journal WPCF*, Vol. 48, 1976, p. 1824.
35. Trickling filter plants had the most trouble meeting the secondary criteria. Activated sludge plants performed best. Gilbert attributed this difference to the lack of operational flexibility inherent in the trickling filter design.
36. Gilbert (1976), p. 1827.
37. U.S. EPA, *Clean Water: Report to Congress 1973–74*, 1975.
38. Initially, the study area was divided into two sections, with one contractor surveying plants in the western United States and the other surveying plants in the East. Plants selected for the study employed biological treatment processes and had a history of poor effluent quality. Any plants receiving inflow above design criteria (that is, plants receiving hydraulic or organic overloads), as well as plants under current enforcement actions, were excluded. Due to hydrogeologic differences, the eastern contractor did not exclude plants on the basis of excessive infiltration/inflow alone, while the western contractor believed that this was an extreme circumstance rarely occurring in the western United States that justified exclusion. Albert C. Gray Jr., Paul E. Paul and Hugh D. Roberts, *Evaluation of Operation and Maintenance Factors Limiting Biological Wastewater Treatment Plant Performance*, (EPA Municipal Environmental Research Laboratory, Cinn., Ohio.), July 1979, p. iv.
39. *Ibid*, p. 37.
40. Bob A. Hegg, Kerwin L. Rakness and James R. Schultz, *A Demonstrated Approach for Improving Performance and Reliability of Biological Wastewater Treatment Plants*, (Report no. EPA-600/2-79-035, EPA Municipal Environmental Research Laboratory, Cinn., Ohio., June 1979, p. 43.
41. Bob. A. Hegg, Kerwin L. Rakness, James R. Schultz and Larry DeMers, *Evaluation of Operation and Maintenance Factors Limiting Municipal Wastewater Treatment Plant Performance: Phase II*, U.S. EPA, Municipal Environmental Research Laboratory, Cinn., OH., August 1980, p. iv.
42. *Ibid*, pp 58–59.
43. Hegg, et. al. (June 1979), pp. 15–16.

44. U.S. EPA, *Handbook: Identification and Correction of Typical Design Deficiencies at Municipal Wastewater Treatment Facilities*, April 1982, p. iii.
45. *Ibid*, p. 1.
46. U.S. EPA (September, 1993), p. 1.
47. Melissa Horne, "Construction Grants Program: Past, Present and Future," *WATER/Environment and Technology*, Vol. G(4), December 1989, p. 507.
48. In 1973, when federal grants for wastewater treatment were just beginning, displacement of local funds was estimated to be 200 percent of federal grant funds, thus actually producing a net decrease in funds available for wastewater treatment. James Jondrow and Robert A. Levy, "The Displacement of Local Spending for Pollution Control by Federal Construction Grants," *American Economic Review*, Vol. 74, No. 1–2, 1984, p. 177.
49. Of this \$60 million, over \$53 million was in grant form. U.S. EPA, *Partners Rebuilding America: Public-Private Partnerships in Wastewater Finance* (EPA 832-F-93-004), May 1993, p. 1.
50. Richard R. Noss and David H. Marks "Urban Impacts of EPA's Construction Grants Program," *Journal of Urban Planning and Development, American Society of Civil Engineers*, Vol. 107, 1981, p. 35.
51. Horne (1989), p. 509.
52. Bob A. Hegg, James R. Schultz, Charles S. Zickefoose, and Fred Matter, "Achieving Wastewater Compliance with Reduced Grant Support," *Journal WPCF*, Vol. 56, September 1984, p. 1101.
53. *Ibid*, p. 1101.
54. See U.S. Comptroller General, "Multibillion Dollar Construction Grant Program: Are Controls Over Federal Funds Adequate?," 1977; U.S. General Accounting Office, "Environmental Protection Agency's Construction Grant Program—Stronger Financial Controls Needed," 1978; U.S. GAO, "Costly Wastewater Treatment Plants Fail to Perform as Expected," 1980.
55. U.S. Comptroller General (1977).
56. U.S. GAO (1978).
57. U.S. Comptroller General, (1977).
58. Horne (1989), p. 510.
59. Hegg, et al. (1984), p. 1010.
60. The EPA study identified one community that was convinced it needed a grant to achieve compliance. As a result, plant administrators did not initiate minor repairs that were seriously affecting plant performance. Instead, the administrators did as "little as necessary" and focused their attention on preparation of their grant application.

Ironically, part of the application required communities to consider optimizing the performance of their existing plant. However, the community had taken few steps in this direction. Through the CCP, which focused on improved training and technical guidance, plant operation improved substantially without the need for major construction or repairs. As previously noted, the CCP study revealed that such attitudes which place the acquisition of federal funds above the goals of the Clean Water Act are not uncommon when federal money provides much more to a community than just the potential to comply with the Act. (See Hegg, et al. (August 1980) pp. 48–49).

61. Hegg, et al. (June 1979), p. 5.

62. *Ibid*, p. 5.

63. Only MWTPs with a "history of delay despite pressure by the Agency to proceed" and MWTPs which are already determined to have adequate physical structures capable of meeting effluent limitations, but were not meeting those limitations, were suggested candidates for referral for judicial action. All other plants were eligible for a postponement of regulatory deadlines or recommended candidates for receipt of compliance schedules set forth in Administrative Orders.

64. In the legislative history of the 1972 FWPCA, Congress stated that funding would be "subject to the usual presidential responsibility for evaluating these needs in relation to other national priorities" and declared that funding was provided to "catch up with the backlog of wastewater construction needs and (in the future) municipalities would be expected to provide for operation, maintenance, expansion and replacement of their treatment works." The legislative history of the 1981 CWA amendments stated "it is important to avoid giving states and municipalities the impression that federal funding will be available in perpetuity to meet all of these localities' described needs." (See Lawrence Jensen, "Facing the Challenge," *American City & County*, September 1986, p. 72).

65. Water Quality Act of 1987—Veto Message on H.R. 1, White House, January 30, 1987.

66. Hegg, et al. (1984), p. 1011.

67. *Ibid*, p. 1011.

68. For example, staffing estimates provided in EPA publications often "vary considerably from those found in the field, often exceeding them" (see Ralph H. Clark, "Developing Operating Budgets for New Small Municipal Wastewater Treatment Facilities," *Cost Engineering*, Vol. 28, No. 8, August 1986, p. 10). The resulting excessive salary expenditures decreases the amount of money otherwise available for training and other operation expenses.

69. Hegg, et al. (1984), p. 1011.

70. U.S. EPA, *A Preliminary Report to Congress on Training for Operators of Municipal Wastewater Treatment Plants*, 1984, p. i.

71. P.L. 91-224, §5(g)(1).

72. U.S. EPA (1984), p. 5.
73. *Ibid*, p. 9.
74. *Ibid*, p. 10.
75. Hegg, et al. (1984), p. 1010.
76. *Ibid*, p. 1010.
77. "City Victim of Technology?," *ENR*, Vol. 212, No. 16, 1984, p. 32.
78. *Ibid*, p.32.
79. State agencies frequently review standard design plans while some advanced technologies require special review by the federal EPA.
80. One state review agency reported that comments on design plans for large plants may run as long as 40 pages (see John G. Heilman and Gerald W. Johnson, *The Politics and Economics of Privatization*, 1992, p. 87).
81. Krista S. Reed and C. Edwin Young, "Impact of Regulatory Delays on the Cost of Wastewater Treatment Plants," *Land Economics*, Vol. 59, No. 1, 1983, pp. 35–36.
82. In contrast, communities constructing plants without federal assistance (and therefore without attached EPA design restrictions and review delays) are free to employ more flexible designs such as modular plants which are designed in expectation of future upgrades.
83. U.S. EPA, (April 1982), p. 1.
84. U.S. GAO, (1980).
85. WPCF Plant Operations Committee, "Criteria for Project Performance Certification," *Journal WPCF*, Vol. 60, No. 1, 1989, p. 27.
86. Congress allocated \$8.4 billion for capitalization grants between 1990 and 1994. States were also allowed to capitalize SRFs with a portion of their construction grant funds available through 1990. See Beth L. Starr, *Funding Wastewater Treatment Facilities: The Complete Guide to the New State Revolving Fund Program* (Washington, D.C.: Bureau of National Affairs) 1988, p. 1.
87. A revolving fund provides a continuous source of funds for wastewater treatment if the fund's proceeds are loaned, not granted, to communities. The funds are sustained through repayment of loans made from the capitalization grants.
88. U.S. GAO, "States' Progress in Developing State Revolving Loan Fund Programs," March 1991, p. 6.
89. Title II of the Clean Water Act lists 16 requirements that apply to SRF projects or state administration of the SRF. These include requirements that the loan recipient consider alternative and innovative technology, consider potential recreational and open space opportunities, apply the Davis–Bacon Act, and perform value engineering reviews on projects exceeding \$10 million. It also lists requirements applicable to the state

including requirements that specify types of projects eligible for SRF funding. (Starr, (1988) pp.7–8 provides a list of these requirements).

90. Like the Title II requirements, these laws and executive orders apply to loan recipients as well as the states. Local governments must comply with such regulations as Executive Order 11593 - Protection and Enhancement of the Cultural Environment, P.L. 93-291 - Archeological and Historic Preservation Act of 1974, and P.L. 89-665 - National Historic Preservation Act, all of which promote identification and preservation of historic sites, 42 USC 7506(c) - The Clean Air Act, 16 USC 1531 - Endangered Species Act, P.L. 94-135 - Age Discrimination Act, and at least 16 other executive orders and federal laws. States must ensure that local governments comply with federal policies such as Executive Orders 11625 and 12138 which promote employment of women and minority contractors, the Contract Work Hours and Safety Standards Act which limits work weeks to 40 hours unless overtime payment equal to at least 150 percent of standard wage rates is provided, and the Davis-Bacon Act which requires that contractors pay the area's prevailing wage as defined by the Secretary of Labor. (Starr (1988), pp. 16–17 provides a list of these laws as well as copies of the relevant text (appendices O through CC)).
91. Starr (1988), p. 5.
92. *Ibid*, p. 5.
93. U.S. EPA, "State Revolving Fund (SRF) Final Report to Congress," October 1991, pp. 1–5.
94. For example, some communities encouraged by the CGP to finance expensive, inappropriate, centralized facilities are now turning to low cost on-site systems. See U.S. GAO, (1992), p. 15.
95. U.S. EPA, (October 1991), pp. 1–5.
96. U.S. EPA, (October 1991), pp. 1–7.
97. U.S. GAO, (1992), p. 6.
98. *Ibid*, p. 16.
99. *Ibid*, p. 17.
100. *Ibid*, p. 23.
101. See State Water Pollution Control Revolving Funds, Conference Substitute in Conference Report to accompany S.1128: Some municipalities have developed, or may develop in the future, innovative financing arrangements involving private ownership and operation of portions of municipal sewage treatment systems. It is not the intent of this section to prohibit or discourage States from using their revolving loan funds to support the publicly owned portion of such treatment systems. Reprinted in Starr (1988), p. O-29.
102. "Financing Water Quality Improvements," in *Recommendations for the Reauthorization for the Clean Water Act*, Water and Environment Federation Executive Committee, April 19, 1991, p. 12.

103. Gerald W. Johnson and John G. Heilman, "Metapolicy Transition and Policy Implementation: New Federalism and Privatization," *Public Administration Review*, Vol. 47, 1987, p. 474.
104. U.S. EPA, (May 1990) p. 4.
105. Lawrence Jensen, "Facing the Challenge," *American City & County*, September 1984, p. 74.
106. Laurence J. O'Toole, "Goal Multiplicity in the Implementation Setting: Subtle Impacts and the Case of Wastewater Treatment Plant Privatization," *Policy Studies Journal*, Vol. 18, 1989(a), pp. 10–11.
107. For example, Metcalf & Eddy operated the city of Auburn's wastewater treatment plants while the city waited for two new plants to complete construction. By increasing operating efficiencies, Metcalf & Eddy lowered the City's operating costs by \$35, 271 in a 14-month period. ("Privatized Wastewater Facility in Auburn," *Alabama Municipal Journal*, September 1986, (Reprinted in *Current Municipal Problems*, 1987, Vol. 14, pp. 65–66).
108. Chemical costs for wastewater treatment in Fall River, Massachusetts fell 25 percent after the city joined a regional operation contract which enabled bulk chemical purchasing. (Karen B. Carter, "Private Contracts for Public Work," *Journal Water Pollution Control Federation*, July 1985).
109. Schenectady, New York contracted with Professional Services Group (PSG) to operate and maintain its wastewater treatment plant that had experienced extended odor control problems. The contract is expected to save about \$1.5 million over the first five years of operation. ("Odor Problems Solved in Schenectady," *American City & County*, 1991, Vol. 106, No. 10, p. 34.)
110. In 1986, Brockton, Massachusetts constructed an advanced wastewater treatment facility with 75 percent funding from the CGP. The city was unable to raise enough revenue to cover O&M costs because of a state-imposed property tax ceiling. In 1988, Brockton contracted with PSG to operate and maintain the city's wastewater water filtration facilities. Contract costs were limited to \$500,000/year less than the city's previous costs and PSG provided up front the estimated \$5 million in savings generated over the 10-year contract. (Personal communication with PSG, October 1993).
111. Richard J. Girouard and David L. Phillips, "Contract Operations Save Over \$1 Million," *Public Works*, Vol. 116, 1985, p. 60.
112. See, for example, *United States vs. City of Detroit*, 476 F. Supp. 512 (E.D. Mich. 1979).
113. For a review of necessary contract terms for O&M contracts, see Roger Hartman, "Contracting Water and Wastewater Utility Operations," Reason Foundation Privatization Center How-to Guide #8, June 1993 and Roger Hartman, "Contracting Out O&M," *American City and County*, September 1992.
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115. Kenneth R. James, "Turnkey Treatment Plant Upgrade," *Public Works*, Vol. 119, 1989, p. 71.
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127. Patrice Hill, "EPA Finance Board Asks Administrator to Support Reforms of '86 Bond Curbs," *The Bond Buyer*, October 2, 1991, p. 1.
128. S. 1681, "Municipal Wastewater Treatment Private Investment Act," *Congressional Record*, November 18, 1993, S 16224.
129. U.S. EPA, (1989), p. 56.
130. Current Municipal Problems (1987-88), p. 61.
131. Former President George Bush, "Executive Order 12803 of April 30, 1992, Infrastructure Privatization," *Federal Register*, Vol. 57, No. 86, May 4, 1992.
132. "Sale of Franklin Area Wastewater Treatment Plant Moves Forward," *Privatization Watch* (Los Angeles: Reason Foundation) February 1994, p. 1.

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