

EFFICIENT MANAGEMENT POLICIES FOR URBAN WATER SUPPLY

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October 1970

No. 19

## EFFICIENT MANAGEMENT POLICIES FOR URBAN WATER SUPPLY<sup>1/</sup>

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This paper attempts to spell out the difficult conditions faced by urban water supply managers in achieving overall efficiency. Based upon these conditions, and changes that are likely in the next decade, it then tries to suggest strategies that would lead to even higher levels of efficiency in the future. A blending of political and economic concepts is used to make what is hoped to be a realistic analysis.

What do we mean by "efficient?" The usual welfare economics definition is attainable only under a very special and highly unrealistic set of institutional arrangements. As soon as we delegate responsibility to a specialized agency we provide the opportunity, indeed we make it imperative that, in a social sense, a sub-optimization will take place.

From the specifics of the indictment of this sub-optimization we can learn something about the opportunities for more efficient management in the future. In general there is an under-exploitation of multiple-function, multiple-objective opportunities.

The pressures for sub-optimization hinge very directly on the sources of support and opposition to the water supply agency. A change requires the creation of a broader political base.

The search for regional solutions is largely a political problem, and probably the development of the flexible, responsive regional agency, so long sought, is still the answer.

Key Words: Institutions, Urban Water Supply, Regional Organization, Public Policy

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<sup>1/</sup> An early version of these thoughts was presented at the Spring 1970 Conference "Water in an Urban Environment" sponsored by the American Society of Civil Engineers at Catholic University, Washington, D. C. March 31, 1970. Proceedings are pending. Discussion there, reviews of current studies with Ruth Mack, Mark Cannon and others at the Institute of Public Administration, New York, N.Y.; comments from Leonard Dworsky, Eugene Eaton, James Finley, Larry Libby, Arthur Maas, Lyle Raymond, Harry Schwarz, John Shaeffer, and Norman Wengert are responsible for improvements. Obviously deficiencies are still the burden of the author. This paper was developed in part while the author was Visiting Professor with the Program Planning Group (Civil Works), Office of the Secretary of the Army. This paper was presented at the 6th American Water Resources Conference, Oct. 26-30, 1970, Las Vegas, Nevada.

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### What Do We Mean By "Efficient"?

What do we mean by "efficient" when we apply it to urban water supply? In terms of welfare economics it might be put this way. It would be a water supply system where any change would mean a net decrease in social benefits. It would be where no change in delivery capacity or usage pattern can be made where the total value of the gain, or the benefits, caused by the change exceed the value of the corresponding losses or costs. This, of course, assumes that opportunity costs as well as direct costs are considered, intangible or extra-market values as well as tangible or market values, and it considers opportunities for the joint production of non-water supply products as well as external effects of water supply activities on the rest of society. Even more to the point, it assumes a decision-making structure and process (1) that is unbiased and evenhanded with respect to the incidence of the full range of benefits and costs, i.e., it assumes unbiased political access, (2) that is able to judge the effects on, and values held by, all segments of society including the very difficult task of judging the rapid and dramatic shifts in these values, (3) and is able to impose the results of evaluation, either by causing the beneficiaries to compensate the losers or otherwise preventing the losers from blocking the change and forcing compromise or inaction.

Obviously reality may be different from this and this may stem primarily from two factors: first, the delegation of responsibility to agencies, and second geographic and institutional fragmentation of political constituencies. Individually, and even more so when acting together, these conditions provide the opportunity and, as is sometimes argued, provide an imperative to sub-optimize in the provision of urban water supply. A review of the alleged opportunities foregone in such sub-optimization should provide some insights into the character of the gains and costs to be had from more efficient management policies for urban water supply. But even more to the point, it should indicate some of the means by which such policies can be achieved, or at very least the kinds of gains that might provide the incentive for different decision-making arrangements.

Even the governments of very small urban entities have usually found it advantageous to create specialized water supply organizations or agencies. The result is that in the performance of this function there is a tendency to simplify decision-making by narrowing objectives and criteria to those that have a direct relevance to the assigned function. This is heightened as related agencies define their territories. The interface between one agency's responsibility and another can become a kind of no-man's land. Most relevant here is the separation of the water supply function from land use planning and control, including urban renewal, drainage and flood control, recreation, and particularly sewage collection and treatment. Relevancy should be established by the degree of potential complementarity or competitiveness between the functions. Of course, some very important and relevant social values may fall outside the interest of any other agency in a particular jurisdiction.

Combining political fragmentation of the urban area -- i.e., the service area -- and the hydrologic units -- i.e., the potential supply system has, of course, long been recognized as a principal challenge to comprehensive

and planned development of the nation's water resources. The problem of internalizing the external effects of individual action, effects that are transmitted largely through the hydrologic system, remains a principal justification for a strong Federal role in water resource development. Federal involvement in urban water supply has been less than in other functional areas in the past, but this may change significantly. It should be justified, in part, on the demonstration that such internalization of external effects is worth the effort.

Advocates of greater integration, with proposals for regional governments and the like, have had only modest success in achieving reform. State governments have responded in various ways -- sometimes with an outgrowth of a public health oriented regulatory activity, sometimes with a general water resources regulatory and planning activity. An informal sampling of opinion in professional circles seems to indicate that it is clear to many that the gains from integration would be worth the cost in terms of the loss of agency autonomy and the loss in some degree of self-determination by local units of government. But it is not clear that it is going to be easy to find the political energy, fueled by the benefits of change, needed to overcome the inertia of reorganization. With the current interest in the environment this may be easier for waste management, and, of course, pollution control and water supply can be related.

#### Some Alleged Effects of Sub-Optimization

After all, we can look back on an impressive record of accomplishment in urban water supply. Dedicated, visionary men have worked well ahead of need. Essentially no one in an urban area goes without water. Water is low-priced, abundant and of high quality. The gains in public health control have made a modern industrial society possible. The great drought of the 60's in the Northeast has been a most useful prod to a needed review of the future -- we are going to put as much more capacity to serve people into that area over the next generation cycle as we built up in the history of the nation. But the rather small losses suffered due to that drought stand as testimony to the effectiveness of our urban water supply agencies. Nonetheless a list of shortcomings can be drawn up. They are a collection of sometimes trivial, but hopefully avoidable, costs of sub-optimization. They may provide more of a guide to improved performance in the future than they have in the past.

#### Economies of Scale.

Of course at the heart of some of these opportunities for the future is the potential for reducing unit costs through larger systems. Larger treatment plants have unit cost advantages over smaller plants. Collection and transmission system costs offer some advantages when rationalized over a larger service area. Larger systems offer the potential of meeting drought insurance needs with less installed capacity because of the possibilities of taking advantage of differences in degree of drought across a region. More system inter-connections in the New York metropolitan area in the 1960's could have achieved some reduction in drought losses. Also larger systems and larger agencies have opportunities to exploit more highly trained manpower, and some fiscal economies. Perhaps more to the point, the consolidation or at least coordination of systems should lead to a lessening

of competition for sources. Sources are over-preempted by some, leading to overinvestment and wasteful use of resources, while others face undercapacity.

#### Multiple Means Opportunities.

There is a suggestion in the pattern of development that reservoirs in more distant upland areas have been developed more than would have been necessary and at higher cost than if ground and surface water management could have been more fully integrated and if water quality and water supply management had been more fully integrated. A real cost, largely external to the agencies, has been the impact of upstream reservoirs on the natural environment. Although this, in a way, may be partly offset by the land use controls some water supply agencies have imposed around their reservoir areas. These areas now offer more and higher quality natural environments, albeit often with highly restricted entry than might have existed otherwise. But the point is that this was probably never a major management objective.

Los Angeles, Long Island, Southern New Jersey, and parts of Southeastern New England, among others, offer opportunities where ground water reservoirs exist that could be more fully used to balance off seasonal variations in surface water supply. Los Angeles may be furthest along in exploiting this opportunity. Managing ground water recharge is closely related and both Los Angeles and Long Island have some significant storm water spreading policies, and are experimenting with the recharge of reclaimed waste water.

In the years ahead there may be more to the old saying that if everyone had to withdraw his supply downstream from his outfall, there would be no pollution. Separation of responsibility for supply management from water quality management has undoubtedly reduced some of the potential for preventing pollution. At least two issues remain uncertain. First, how important and how difficult of solution is the maintenance of taste and visual quality and virus control? Second, how important and difficult of solution is the esthetic barrier to the use for water supply of what are now polluted sources? If we can get high quality fisheries reestablished in the Hudson and the Merrimac, will this be enough improvement to allow political acceptance of the use of the unregulated flow of these streams for Boston and New York? The potential of using these streams in their high flow periods could free the existing upland reservoir capacity of these cities for use in the low flow period. Since aqueducts would need to be enlarged to allow full system supply for part of the year, this would amount to substituting transmission investments for reservoir investments. But in addition to fiscal feasibility, political acceptance may depend upon demonstrated pollution control capability. Use of the Potomac estuary as a supply source for Washington, D. C. and a number of other situations are quite similar in this respect. Integration of the supply function and the waste management function is very much at issue to this political acceptance. Note that linking sewer and water functions in a single jurisdiction is no solution here. More to the point would be linking a downstream city's water supply activity with the upstream city's sewer department.

It is a well known fact that urbanization increases surface runoff. It is also becoming clear that urban storm drainage is an important contributor to the pollution of receiving streams, as well as being an annoying and

costly source of flood damage. A clear long-term challenge to urban water supply management is to find ways to combine the solution of these several problems to the advantage of urban supply. Again a study of the New York metropolitan region suggests that urban runoff does represent a significant nearby source. If it could be harnessed, if only for some industrial and other less demanding uses, it might replace other additions to capacity for several decades. But in terms of the technology of collection and treatment, we may be some way off in putting this source into our supply mains, and even further off in terms of organizational problems. Of course the well-recognized pollution problem of overflows from combined storm and waste water sewers is a part of this possibility. Since both carry wastes it is not clear that separation is the best answer. At present those concerned with urban water supply are often free to leave these problems in the "hold basket" on someone else's desk.

#### Demand Management.

Also in recent years there has been more discussion of demand management as a counterpart to supply management. The use of pricing as a management tool in addition to being a means to obtain revenue has been discussed by a number of economists. Economists respond to the inequity of charges which do not reflect incremental costs but also see price as a way to bring use into balance with supply. In general water use is quite insensitive to price changes. Metering is said to have some effect when first installed and less thereafter and in any case only slightly delays the effect of population, industrial and income growth -- more important determinants of use than price. But these hardly exhaust the means of managing demand. In time of drought we resort to appeals and various regulatory devices. Do we know enough about how well these work and what can be done between the droughts to make them more effective? Might we not take a page from the book of the insurance industry? They increase profits or cut losses from accident insurance by underwriting the development of safety technology and then promoting its use. Sometimes its use is a condition of insurance. Should it have taken a drought to encourage Northeast manufacturers to adopt water-saving measures? In many cases they found a significant savings in costs even at existing prices for water. The point is that water supply agencies in protecting the public interest probably should have a real stake in the development of new technology. Research and development as a strategy in planning is the broader question and applies to many other aspects of water supply development. Larger agencies are more likely to be successful in applying such a strategy.

#### Multiple-Function Opportunities

Another criticism of water supply agency operating policies is that they often compound the loss of opportunity to reinforce other means of shaping the pattern of urban growth through controlling utility extensions. Urban sprawl is almost impossible to manage with the tools available. Too often zoning alone is expected to define the urban shape, keep down the costs of public services, provide for open space and all the rest. But no zoning ordinance can withstand the pressures of potential capital gains to landowners if sewer, water, power and highway services have been developed to a different plan. This is only part of the more general criticism that we have failed to exploit multiple-function, multiple-objective opportunities in our

urban areas. For other examples, hiking and cycling trails on top of aqueducts are far less common than the number of opportunities provided by water conduit rights of way. Recreational use of reservoirs and watershed lands is almost a classic area of controversy. In eastern New England there is an historic abandoned canal which links a number of unbuilt open swampy areas. It might be used to bring water to a stream over-committed for water supply. It could be a ribbon of open space and wild life habitat through an urbanizing area. But even if we grant its feasibility for such a multiple-use possibility, it is probably unreasonable to expect water supply agencies to take the lead in such a multiple objective development under existing policies.

### The Pressures for Sub-Optimization

It is one thing to identify such opportunities; quite another to understand what brings them about and thus what might be done to seize them. The pressures for sub-optimization are very real and are the key to achieving more efficient policies. Some hypotheses are presented here.

### Sources of Support.

Probably above all else it is important to understand the sources of support for and opposition to existing policies. In general direct interests provide a stronger basis of support or opposition than diffused interests. Understandably those persons who see a relatively high per person self-interest that is tangible, immediate or certain, are more likely to organize effectively to make their concerns known in the decision-making process than the potential recipients of relatively small per person effects, that may also be intangible, future or uncertain. Constituencies of existing water supply agencies are more likely to fall in the direct category. A review of the above opportunities shows that the beneficiaries of the new policies suggested are likely to be in the diffused category. In other words, the managers of a water supply agency are expected to take into account the self-interest of the community that employs them and particularly those in it who substantially benefit from their services, or they can expect a certain amount of job insecurity. Those who would have it otherwise must produce an effective, broader political base to go with the broader policies. The traditional prescription is involvement of higher levels of government that do enjoy a broader political base, and this still seems to be the general answer.

Within this need for a broader base of support lies a corollary principle, the lack of correspondence or symmetry between the consequences for agency managers and the affected public from the same events. The academic economist can tell the responsible engineer that a given amount of drought is the dividing line between a socially efficient amount of capacity and an excess. This may optimize social well-being as the economist sees it. And the savings in supply costs from enduring some drought can be substantial. In the case of a number of large potential systems being studied for Boston, a willingness to absorb the costs of a 1% chance of a 10% shortage leads to about a one-fifth reduction in the present value of system costs. Savings go over one-third if a 20% shortage can be endured with a 1% risk. Similar estimates for the New York region show substantially larger potential savings to offset the costs of drought. Another way of putting it is that if users were willing to adjust consumption to meet shortages up to 10% of projected

use a fund available from system savings would be made available to compensate those who would lose from shortages of 10% and over. This fund would amount to 10¢ a gallon in Boston and 3.5¢ in New York for the uses foregone due to the shortage.

But it may appear to the engineer to be more responsible to convince his supporters to endure the costs of some over-capacity in the supply system than to convince the electorate that a given amount of drought -- at the time of the drought -- is worth enduring. The costs of the over-capacity are diffused and the costs of the drought quite direct, and the manager is the scapegoat. There are probably many other reasons that system managers have a strong preference for over-capacity. Not the least of these is the uncertainty surrounding the timing of decisions to add to system capacity. But the point is that those who would have it otherwise need to devise means to protect the agency from this lack of correspondence between the costs to the public and the costs to the agency. It seems quite likely that one of the more important effects of a tough Federal stance on water pollution standards and enforcement is to give this kind of protection for state and local managers of water quality programs. Failure on the part of Federal funding to materialize has worked in the opposite direction.

#### Effect of Professionalism.

Managers of water supply systems, as in most specialized governmental activities, develop a sense of professionalism and a sense of belonging to an important social group made up of their fellow professionals. Rules of conduct and accepted practice develop and are an important source of criteria for what constitutes "a job well done." The workmanship ethic is a strong motivator. More than one man has been under pressure for sticking to his sense of what was right, taking great comfort and perhaps finding a new job as a result of the support of his fellows. While this professionalism provides an important source of stability, it can also be a drag on adjustment to new circumstances. Not the least of this is an interest in maintaining one's own sense of accomplishment and responsibility. But once the need for innovation becomes clear to the group, communication in the group provides a means for extending it to the whole field.

Federal or state participation in the funding of regional water supply systems could have the potential of providing protection to local system managers from this lack of symmetry of the effects of system management. It could provide a convenient means to pass the buck for the rare shortage, justify the adoption of multiple purpose, and multiple means approaches and the like. The risk is that the State or Federal programs will respond to local managers as a clientele group, reflecting the managers values in policy rather than trying to pursue broader goals. The phenomenon of the regulatory agency which becomes the captive of the groups being regulated after the enthusiasm of reform dies down has its variation here. Some protection from this could be afforded by the structuring of representation on review bodies and the like.

The importance of this phenomenon seems particularly apparent in two ways in the urban water supply field. First, the specialized state and Federal regulatory, granting, planning and construction agencies tend to be



staffed with people in the same general professional group, but with some opportunity for exposure to pressures from a wider variety of interests. Second, the private consulting firms, likewise a part of this group, are heavily dependent upon local governments for their employment, indeed are often the major vehicle for the smaller municipalities to obtain technical assistance including advice as to their self-interest in potential regional arrangements. And it seems likely that these private consultants may see some short-run self-interest in maintaining the status quo. This suggests that it may be important to devise any new arrangements to include a role for such consultants. Tacticians for change would do well to recognize and explore these phenomena.

Metropolitan water supply has increasingly been brought into the purview of regional water resource planning, but the programs of the major water agencies who support such planning provide only limited means of influencing the decisions of local managers or of providing for the access of various interests to these managers. For example, no federal agency could completely ignore fishery interests in its planning of an impoundment. Bargaining to accommodate them can reach highly refined levels. But the means to provide the same bargaining on a municipally built reservoir is limited.

#### Local Autonomy.

Pressures for sub-optimization include the perception on the part of many local officials and their supporters of a link between control of water supply and the achievement of particular economic development objectives. It seems fairly well established in the professional economic literature that availability of excess capacity has little effect on inter-regional economic competition of urban located industries. While a complex of other factors may weigh more heavily in the choice of location between one multi-community area and another, location within one such region may be somewhat more sensitive to the terms and availability of water supply services. What seems fairly certain is that local interests perceive that changes in intra-regional availability of water will shift the balance of competition between communities. I have argued elsewhere that for more developed regions it is probably more important to have effective planning than excess capacity. But in any case those who would regionalize and rationalize water supply would do well to consider this and try to find a means to accommodate it.

A final and catch-all consideration that suggests itself is the general problem of the legitimate concerns on the part of local groups to put more of their fate into the hands of their neighbors. Interest in self-determination, the insecurity and uncertainty about the future that goes with putting trust in the hands of outsiders are legitimate concerns of local government and find expression in urban water supply. There is after all some truth in the adage that when responsibility is diffused a lot of small mistakes may result, but when it is concentrated there is an increase in the potential for more massive mischief as well as for good. Again, moves to regionalization must recognize this concern.

### Regional Solutions - A Political Problem

The search for regional solutions as a means toward more efficient management is largely a political problem rather than an engineering task. The need is for a regional agency that "all" or at least "more" can trust. It may be that this will be easier in the future than it has been in the past if the following observations are correct.

#### Political Cost Increases Suggest Broader Coalitions.

Future increments to water supply capacity will be much more expensive than in the past. This is much more than the fact that the cheaper sources are already developed or made increasingly expensive by other development of the remaining sites. Money costs per unit of capacity will be higher, but this comes at a time when the competition for urban sources of funds is accelerating dramatically. But more to the point, the cost in political capital and time will be even more significant. Already planning schedules have lengthened to decades instead of years. Suddenly the power to veto projects is held by many agencies and interests. Urban water supply agencies were recently denied access to some of the lowest investment cost sites in upstate New York by unanimous votes of both houses of the state legislature. The urban water supply agency is hemmed in on all sides by a new environmental sensitivity and the need to compete with many other groups not only for the use of the resource but also for the public's attention. The smaller agencies may be at an increasing disadvantage. But even the larger systems may find it advantageous to seek support from those interested in other categories of water use benefits.

In turn the environmental coalition -- as the loosely related groups that take an active role in the identification and protection of natural areas have been called -- may come to support attempts at regionalization more effectively. They should enjoy greater access at a regional level of organization than they would at the individual municipal level.

A relative decline in the political power of water supply agencies may imply that they will be more interested in forming broader coalitions. A basis for mutual support could come from combining the like interests across several jurisdictions. But it could also come from developing multi-functional, multi-objective programs or some combination of the two approaches. In any case, coalitions are "paid for" out of program adjustments. The work of the cost-effectiveness analyst is going to become more difficult rather than less.

Traditional approaches to urban water supply may be the best by the criteria that we have used for this function in the past. But does the newly rediscovered problem of pervasive contaminants change the criteria for the future? Are mercury, lead and the like amenable to the traditional defenses of treatment and control of the watershed upstream from the intake? Or must we move to more direct control of emissions? Will more success at such control reduce the need for separating domestic water supply from other functions? I suspect improved control of contaminants coupled with improved renovation technology and rising acceptability of the use of renovated water for many purposes including drinking, will make the integration of urban supply with other water-related activities much easier because our criteria for

technical adequacy will become more flexible. This should make regionalization on a multiple-functional, multiple-objective basis easier for the professional people involved to accept.

Also the stature of planning and water-oriented state and regional agencies is growing (Councils of Governments, regional planning groups, basin arrangements of many kinds). More states and cities find value in them. The modest investments by the several Federal programs that help fund them are bearing fruit (Water Resources Council, Department of Housing and Urban Development, Federal Water Quality Administration). And other aspects of the growing Federal role also should help to move toward regional solutions and perhaps multi-objective, multi-functional activities as well. The Northeast Water Supply Study (NEWS) is a significant example. The competition between Federal agencies to solve the problems in the various river basins may be showing signs of producing results that would be supportive of broader regional solutions. Its time may have come. For example, repeated efforts by the Corps of Engineers to provide water supply for Washington, D. C. over the past decade have not met with the success hoped for. This is the one major Northeastern metropolitan area where safe yield of its system already equals current use. The NEWS Study, under the Corps of Engineers, should lead to a better basis for improved cooperation because it is exploring such possibilities more explicitly than in past studies. Not only are regional organizational problems being reviewed but also the potential for the technical integration of water supply and water quality management.

#### Some Possible Federal Strategies

Some past Federal approaches need to be reviewed and some new ones considered, but this should be done from the point of view of the development and support of regional agencies with multi-functional and multi-objective capability as well as Federal agency program development and support. For example, arrangements for sharing the burdens of planning and development could lead to the mutual support of both the regional agencies and the Federal agencies. Planning and construction activities clearly lend themselves to sharing between regional and Federal agencies. So does the sharing of investment costs and even some kinds of operating costs. The pressures for sub-optimization should be recognized in cost-sharing with clear-cut rewards for actions that are a move away from policies that are less efficient. To the extent that they can induce participation in regional arrangements it should be possible to argue that some Federal subsidies are justified if they clearly lead to the gains to be had from overcoming sub-optimization through bargaining. It will not be clear what this entails until more planning and some bargaining is attempted.

In much of our Federal programming for water resources we have not effectively asked what we are getting for our efforts. To simply do what local governments would have done anyway, but now Federally supported, may provide some benefits. Funds will be released at the local level for other things. But surely the big opportunities involved will not be captured. Providing new investments, technical assistance, and political rewards through Federal programs should purchase behavior changes that reduce the degree of sub-optimization.

Inter-agency cooperation, or perhaps collusion is the better term, may be called for at the Federal level. The Federal agencies do or may need new coalitions, too, even those currently riding the wave of environmental interest. There will still be the tendency for each major Federal program to seek its own regional or state level counterpart agency and constituency. But increasingly it seems they are suffering from the problem of field negotiated agreements, such as in basin planning, "coming unstuck" when they get to Washington. Commitments are most difficult to make without Congressional and Executive sanction. We may eventually see strong regional agencies as the basis for providing this kind of political glue. The river basin has not been very effective -- perhaps the urban region will do better.

But such cooperation collusion will not come about easily. It may be that for regional agreements to be effective they will need to find legitimate expression in the budgeting process. For example, there is some dissatisfaction with the extent to which basin planning now produces plans that are effectively integrated across agency programs. There is the suspicion on the part of some that they are the summation of each agency's hopes. But if the linkage of one agency's efforts to another's efforts is to have little recognition in the budgeting of funds, why should it be taken seriously at the field level? Proposals for regional budgets have been made and if implemented might go a long way towards stronger inter-agency integration not only between Federal agencies, but between them and the regional, state and local agencies. A small beginning in this direction might be made more easily for a "new" Federal activity -- assisting in the planning and constructing of urban water supply facilities and related works -- than in the older more entrenched activity areas. In any case, greater rationalization of water resources development may depend upon steps to link planning and budgeting more closely together on both the Executive and Congressional sides of the process.

Also there are always pressures for more effective use of Federal funds. Some improvement on this score must be made to build creditability. More effective control of the uses of the flood plain probably depend upon action above the local governments who now sub-optimize in zoning and similar controls. This is becoming increasingly clear, hopefully, to those who view the rise in national flood damages with alarm. A recent U. S. General Accounting Office review of the FWPCA grant program for sewage treatment works is instructive, too. It found little effect on pollution and a lack of a cost-effectiveness approach in the willingness-to-proceed basis for grants, and called for seizing more of the potential in regional systems. But it did not clearly point out these probably depend upon a regional organization that can bargain out the cost-sharing. That is presumably being left for the agency to work out. Regional systems through regional agencies may have the same potential in water supply for the Federal agencies -- a way to implement more effectiveness in spending.

It is tempting to suggest a direct Federal role in the actual operation of a regional water supply agency. The retail distribution of water would remain a local function, but at least part of the production and wholesaling could be Federal, as in the case of Washington, D. C. by the Corps of Engineers. Certainly this could be the most expedient solution in some cases. It is a club worth having in the golf bag.

The independent metropolitan district and the major city which wholesales to others are the most common forms for organizing regional systems as they exist today. These are often cross-jurisdictional single-function coalitions, but could become more multi-functional and multi-objective. The development of regional systems with multi-multi characteristics may depend upon effective review in the context of a planning area that extends beyond the potential service area and the existing supply regions. But who is to do this? State and interstate compact agencies, urban region councils of governments (COG's) supported by grants from HUD, and others, River Basin Planning Commission in the Water Resources Council program, all are possibilities. But what will be needed to forge the coalitions called for? Can you bargain out cost sharing through such mechanisms? Can you achieve effective technical integration of water quality investments with water supply, for example? We probably won't know until we've had more experience.

This paper has tried to focus on urban water supply. Obviously the main point of it has been to examine some of the ways that water supply does or could interact with other functions and values. A final question that must be asked is if that isn't too narrow a focus if the objective is to do something about sub-optimization as an organizational problem? Is water supply a broad enough basis to develop the kinds of coalitions that will be needed? The point is that it is a place to start.

### References

- Emery, F. E. and E. L. Trist. "The Causal Texture of Organizational Environments," Human Relations, Vol. 18 (February 1965).
- Gysi, Marshall. Comments on "Time -- Capacity Expansion of Urban Water Systems," Water Resources Research, Vol. 6, No. 3 (1970), pp. 993-995.
- Howe, C. W. and F. P. Linaweaver. "The Impact of Price on Residential Water Demand and its Relation to System Design and Price Structure," Water Resources Research, Vol. 3, No. 1 (1967), pp. 13-32.
- Institute of Public Administration. (Forthcoming) Report on Economic and Political Analysis of Regional Water Supply Systems for the Northeast. Northeast Water Supply Study, U. S. Army Corps of Engineers.
- Keluhofner, G. K. Metropolitan Planning and River Basin Planning: Some Interrelationships. Water Resources Center, Georgia Institute of Technology, 1968.
- Libby, L. W. The Political Economy of Water Management. Ph.D. Thesis. Cornell University, 1970.
- Raven-Hansen, Peter. Water and the Cities. ABT Associates, Inc., Cambridge, Mass. for the Office of Water Resources Research, 1969.
- Russell, C. S. The Recent Northeast Drought: Short-run Costs of Water Shortage and Lessons for Water Systems Planning. Harvard Water Program, Discussion Paper 68-10, Harvard University, Cambridge, Mass., 1968.
- Warren, R. L. "The Interorganizations Field as a Focus for Investigation," Administrative Science Quarterly, Vol. 12, No. 3 (1969), pp. 396-419.
- Wengert, Norman and G. W. Walker. Institutional Constraints on the Development of a Regional Water Supply System: The Case of Detroit. AWRA Fourth Conference Proceedings, November 18-22, 1968.
- White, G. F. Strategies of American Water Management. The University of Michigan Press, Ann Arbor, Michigan, 1969.
- Zobler, Leonard et al. Benefits from Integrated Water Management in Urban Areas. Barnard College and Columbia University, 1969.