INSTITUTIONS FOR URBAN-METROPOLITAN WATER MANAGEMENT: ESSAYS IN SOCIAL THEORY

by

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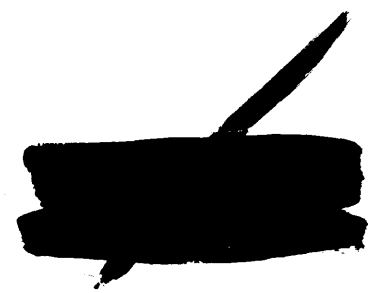

Preface

This set of essays is a part of a larger state-of-the-art survey and literature review on the subject "Institutions for Urban Water Management."

As the survey progressed, and as the literature on the subject was reviewed, it became evident that a set of essays written by scholars from a number of disciplines concerned with the subject might provide useful insights. As initially conceived, a few essays were to be prepared, and these were to have served as a basis for a small working conference. But as work on the project moved ahead, it became increasingly apparent that the field was highly unstructured, and it therefore was felt that a conference would not be very useful. Instead, invitations were extended to the several authors whose essays are included in this volume in the hope that some clarification of concepts might thus result, and that where differences existed, these might be highlighted. These objectives have, to a large extent, been accomplished, and the editor wishes to express his appreciation to the contributors.

It is obvious, of course, that this is not the last word on the subject by any means. For reasons beyond the editor's control, the viewpoints of economists and lawyers have not been included. But it is the editor's opinion that these essays nevertheless represent a significant contribution to social theory. It is hoped that readers will agree!

Norman Wengert

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Introduction

by Norman Wengert

Colorado State University

This volume of essays is a part of a state-of-the-art review and literature survey on the topic of "Institutions for Urban-Metropolitan Water Planning, Development, and Management," supported jointly by the Office of Water Resources Research (U.S. Department of the Interior) and Colorado State University. The study proposal grew out of discussions in which it was recognized that the term "institutions" and its several variants (e.g., institutional, institutional arrangements, institutional factors) were used with some frequency in describing urban water situations. At the same time, it appeared that the term was not always used with precision, and that in fact it seemed to have several definitions, meaning different things to different people. It was because of this apparent confusion that the state-of-the-art review seemed justified, since the purposes of such reviews include clarification of meanings and development of more precise concepts.

Two initial premises of the survey were quickly dispelled. One of these was that there would be a substantial body of literature dealing explicitly with institutions for urban water management. The other was that a working conference focusing on two or three seminal essays would provide a useful way of reaching consensus on the conceptual content of the term. With respect to the first premise, very little explicit literature was discovered. With respect to the second, it seemed more reasonable to ask a group of recognized scholars to contribute essays in which they developed their understanding of the term and appraised its utility for dealing with urban-metropolitan water planning, development, and management. The present collection of original essays is the result.

There is clearly no consensus among the authors as to the proper meaning and use of the term institution, although perhaps a thread of agreement can be found in the several essays. But more important is the fact that the topic has been addressed directly and forthrightly, and perhaps the next step will be to try to reach agreement. In any case, each of the essayists speaks for himself.

Some Preliminary Conclusions

The conclusions of the state-of-the-art review and literature survey are presented in the Final Report of the project, and it serves no purpose to repeat that material in great detail here. It is, perhaps, useful to note that in addition to the several specific definitions which can be identified in articles and reports which utilize the term, it is often used as a kind of "black box" to explain away what might be called the human dimensions of particular situations. For example, failures of plans or programs, or ineffective administration, are often simply attributed to "institutional inadequacies." And problems seem to be designated "institutional" when they involve intransigent socio-political problems or reflect deep-seated social values and beliefs. Thus the term has not infrequently served as an excuse to prevent examination of socio-political and socio-psychological aspects of urban water planning, development, and management.

As is documented in the Final Report, the literature survey on water institutions proved to be particularly difficult because the quantity of literature dealing *explicitly* with the subject of urban-metropolitan water institutions was limited. Although the term is used with some frequency, little attention has been paid to its definition or to an elaboration of a conceptual framework which might be associated with the term.

The difficulty with the word "institution" (and its several variants) stems in part from the fact that it has traditionally been used in several disciplines with related but not necessarily consistent meanings, connotations, and implications. As investigations into the state-of-the-art progressed, it became increasingly evident that:

1. Many uses of the term, particularly with reference to urban-metropolitan water problems, did not include careful definitions;

2. Many users of the term were unaware of the theoretical literature on the subject of institutions and did not seem particularly concerned with what that literature may have said on the subject;

3. There was little harmony or consistency among uses either in the practical literature dealing with water problems, or in the theoretical literature dealing more generally with institutions;

4. Many uses of the term were in fact without significant meaning (e.g., one article reviewed suffered little when the word "institution" was systematically deleted!);

5. When the term institution was used it expressed or connoted many different ideas, one of the most frequent being as a synonym for organization.

It is this usage as a synonym for "organization" that is most to be regretted. Yet it appears frequently in this sense, particularly in federal government documents and reports. In my opinion, this usage which equates institution with organization in the most narrow, structural sense (i.e., a box on an organization chart) is most unfortunate because it tends to lead to misconceptions with respect to institutional development and change, and implies simplistically that institutions, like organizations, can be altered, adapted, or abolished at will. Organizations can be established by legislative or executive command, and in some states, the people, through referenda, may change organizational arrangements, e.g., a city may move from a mayor system to a city manager system. But such changes are often superficial, *unless related to fundamental changes in the attitudes, perceptions, and expectations (the behavior) of the affected citi-*

zens. Putting a policeman's uniform on a man does not make him a policeman. To suggest that organizational tinkering will solve urban-metropolitan water problems may lead to a serious misdiagnosis of the nature of the problems involved.

Many studies, such as those by the Advisory Commission on Intergovernmental Relations, have identified the fact that water functions are highly fragmented in many metropolitan regions. There is evidence, moreover, that such fragmentation increases costs, creates a variety of problems, and is generally dysfunctional. It is common, therefore, to suggest that the solution to the problem is to eliminate fragmentation by creating new institutions through reorganization. This is too simple. The fragmented system which exists in so many metropolitan areas reflects deep-rooted values. In short, fragmentation is institutionalized, and to overcome fragmentation it is not sufficient simply to pass a law or issue an administrative order.

The point to emphasize is that institutions are not simply the organizational pattern which exists at a given time, but rather the socio-political value systems (norms) which in the case of local fragmentation support and reinforce exaggerated development of localism. Unless such values are changed, simply altering organizational arrangements can not be effective. Experiences with reorganizations at all levels of government emphasize that unless one deals with these more fundamental value problems, reshuffling functions and agencies is not likely to bring about very significant change or improvement.

In short, the "art" was less developed than anticipated when the state-of-the-art study was initiated. This may in part reflect the fact that the social sciences are less tightly structured than are most of the so-called "hard" sciences, and that for complex reasons, there is often far less precision in the use of terms and concepts. There is always a temptation in social science research to follow the "Alice in Wonderland" approach of giving such meanings to words and concepts as suit the convenience of the researcher. As Mowitz points out (infra), writings in the social sciences often involve an endless debate over meaning. On occasion, where the stature of the author or the overwhelming logic of his presentation is apparent, the unique definitional approach may set new intellectual paths. But more often it leads to confusion.

It is a premise of this essay, however, that the term "institution" and its several variants can have utility, and that this utility can be increased if the term can be given more precise meaning as it relates to urban water management. The search for precision and intellectual content with respect to the term "institution" is not simply a semantic quibble. It is recognized, of course, that words take on meaning, not by command of a researcher, but through usage. But perhaps this set of essays can contribute to narrowing the meaning, to alerting those who use the term to its ambiguity, and to urging those who use the term to define what they mean by it.

The formal study of the theory of institutions and institutional processes (particularly those related to water resources planning, management, and development) has been largely neglected, and it is hoped that this volume of essays is a step towards remedying this situation. Among the social sciences, sociology has perhaps been most concerned with institutions and institutional processes generally; political science and sociology with organizations and administrative processes; and law with forms of responsibility and control. In economics a school of thought is designated "institutional," but this has a very special meaning.

A few years ago Professor Thomas W. Martin (1968) wrote:

> The concept of social institution is perhaps one of the oldest and most widely used terms in the vocabulary of the social sciences. Its origins trace back to the works of Plato; its treatment as a social variable to the works of Montesquieu; and its usage as a major concept of social order to the 18th century Contract, Moral, and Utilitarian, Schools of Social Philosophy. With the development of "positivistic organicism" in the 19th century, the concept rapidly became a central conceptual device for describing and explaining fundamental characteristics of social structure and order. Later, with the vigorous growth and elaboration of sociology, anthropology, as well as other related behavioral sciences, the concept quickly became developed [sic] into a virtual theory of social order.
>
> Today, despite its continued wide currency, the term social institution has become the object of severe criticism regarding both its present theoretical importance and its operational utility. The question has been raised: what does the concept mean; and, if it means anything, how can it be used to test social reality? . . . .
>
> . . . Noteably absent . . . is a clear and up-to-date definition of the concept institution, at either a theoretical or, significantly, an operational level. Rather, it seems that the concept has steadily come instead to serve as a catchword, an heuristic device, or a "primitive term" to be used as a means for generalizing specific research findings . . . .

Professor Shmuel N. Eisenstadt defines the term as follows:

> Social institutions are usually conceived of as the basic focuses of social organization, common to all societies and dealing with some of the basic universal problems of ordered social life. Three basic aspects of institutions are emphasized. First, the patterns of behavior which are regulated by institutions . . . . Second, institutions involve the regulation of behavior of individuals in society according to some definite, continuous and organized pattern . . . . Finally, these patterns involve a definite normative ordering and regulation . . . . (1968)

Many of the problems in defining the term institutions probably result from the tendency to regard institutions as specific, concrete entities (reification). It might be most useful, as Edward Kaynor has suggested (infra), if the *process* of institutionalization were emphasized, and insofar as it would be necessary to speak about institutions to regard them as end products or results of the process. In this view, government or a government agency would not be an institution, or at least would not be the significant point of examination, but rather the processes by which government activities are institutionalized in order to plan or manage certain public services and to

control citizen behavior would be the focus of analysis and research. In this view an institution is the result of a process or a set of processes by which values are determined and communicated over a span of time, which influence those who for one reason or another are involved or affected by the institution. With this emphasis, one considers the term institution as simply a means for designating the web of interdependencies among law, agency operations, public finance, etc. Thus it is less useful to speak about local government as an institution than to consider the processes which are the institutionalized means for doing such things as planning, developing, and managing particular public services at the local level. Not everything local government undertakes is institutionalized. In some cases the output of the process of institutionalization may be a body of laws and regulations, in others it may be an organization or a group of organizations, in still other cases it might refer to a group of individuals. And of course the appellation "institutionalized" would apply to informal as well as formal aspects of government. For example, the fragmentation of local governments in a metropolitan area is the result of institutional factors which have deep roots in American culture and tradition.

The possibilities of this approach are perhaps suggested by the use of descriptive terms like the "web" of factors, or the system of relationships, or the patterns of behavior. In operational terms the following list of institutional factors, which may affect the management of natural resources, suggests how much broader the concept can be than simply organization.

(1) Private ownership of resources or private rights to use resources.

(2) A federal form of government in which most of the authority over property is vested in state and local governments.

(3) Public ownership of unique, fragile, or scarce resources.

(4) A competitive economy in which the marketplace guides economic production, allocates resources, and distributes income.

(5) A complex system of federal, state, and local laws, regulations, and public programs that are designed to correct or improve the performance of the marketplace.

(6) A broad system of public education from elementary school through college.

(7) Private and semi-public conservation organizations and associations designed to generate voluntary cooperative action by resource users to advance both private and public interest.

(8) Citizen participation through public advisory groups.

It seems less useful, therefore, to speak of institutions as "entities" than to define the ways and means by which behavior is influenced and altered through *institutional processes*.

If institutions should not be defined and classified according to their structure, neither should they be defined and classified simply by their goals. Goals in water management are generally instrumental in nature, seeking to improve the quality of life. Even flood control, as broad as that may seem, is basically a means rather than an end. When one gets to the final goals and objectives, they are often so general and ill-defined that it would not seem operationally useful to classify institutions according to them.

Classification of institutional *processes* in water management is important for the purposes of information retrieval, and also as a foundation for ongoing analysis of institutional activity. As a preliminary taxonomy, institutions may be classified according to the *ways in which they influence behavior*.

(1) *Legal Processes:* The ways in which behavior is influenced through legal processes is through Common Law and legislation concerning water and water rights, the enforcement of that law and those rights, and the resolution of conflict through the adjudicative mechanisms of the law. Thus although water law may be designated an institution, it is the process (i.e., the way in which water law has developed to influence behavior) that is the important dimension in understanding the effects of that body of law.

(2) *Economic Processes:* These are the ways in which behavior is influenced positively through market transactions, through subsidies, or negatively through taxes, or through other economic techniques. In this classification would fall most private sector activity including that of developers, financing agencies, and industry. Government agencies, and all taxing units of government in the public sector have far-reaching impact on individual and collective behavior vis-a-vis water. Economic literature reflects a recognition that the most important determinants of water management behavior may be economic interests that have no direct or primary relationship with water, such as housing developers who influence patterns of urban growth, and hence the demand for water supply and waste-water services.

(3) *Administrative Processes:* Administrative regulations and policies differ from water law in that they are not necessarily codified. They may include procedures by which an organization, public or private, does its work. This classification may thus include the ways in which irrigation companies, municipal water systems, state agencies, and other organizations operate, the policies and procedures they follow, etc.

(4) *Persuasion Processes:* Persuasion is a common way of influencing behavior, particularly by those without direct legal or economic control over a situation. In some cases the processes of persuasion are associated with bargaining processes; Congressional delegations, communities, governmental sub-units use tradeoffs to come to decisions which are mutually beneficial. In other cases, an educational campaign may be waged to inform and influence public or official behavior. A community organization or pressure group may seek to influence legislators or regulatory agencies. Conversely, an agency may seek to influence water users.

(5) *Reorganization Processes:* A subtle, but nevertheless potent, form of influencing behavior may be through the practice of administrative reorganization -- and this may account in part for identifying "institutions" with "organizations." For the common complaint of the lack of coordination in water management, the almost universal cure has been to suggest administrative reorganization on the assumption that this could result in coordinated policies and lead to

more rational ways of achieving goals using various forms of coercion to affect behavior, such as law or administrative regulation.

(6) *Planning Processes:* Another significant way in which behavior is influenced is through planning. This is a primary way in which federal, regional, and state agencies work. Once a plan has been drawn up and promulgated, it is often too late to change it so that individuals and organizations may have little choice but to accept the boundaries drawn or policies decided upon, even though neither law nor administrative regulation is directly invoked to coerce behavior.

(7) *General Social Processes:* Most commonly these are considered as being organically a part of a society, including culture, traditions, and customary ways of looking at things. Accepted usage can often be invoked to prevent innovation, protect interests, and add to the reputation of those individuals who have been around the longest and know the customs of the community, the agency, the organization or department. Even though most are unwritten, they are often stronger than law or administrative order. (This suggests one reason why reorganization often fails.)

(8) *Miscellaneous Processes:* This is a catch-all which includes ways of influencing behavior which cut across one or more of those listed above; for example, the way in which economic interests lobby for the passage of certain legislation, reflecting economic bargaining and legal processes. Or again a report may speak of the institutional aspects of water quality in a certain river basin, referring to the output of many, if not all, of the institutional processes which have been mentioned here.

This taxonomy is obviously eclectic, taking its substance from numerous sources. The essays which follow present a variety of views on the meaning and uses of the term institution as applied to urban water management. In inviting the contributors, every effort was made to allow them the fullest opportunity to express their views on the subject without constraints from me. They did receive copies of the Interim Project Report which stated the extent to which the concept was unstructured and meanings confusing and conflicting. But beyond that they were urged to prepare essays which would explore the subject from the point of view of their respective disciplines and experiences.

The result might have been a set of conflicting and diffuse essays. But in fact the several authors, although writing from different perspectives, are really not far apart in their conceptualization of the term institution and its several variants. It is for this reason that I feel these essays are a significant step forward in giving meaning to and setting boundaries for the term institution and describing an important social process.

The reader will, of course, want to read the essays themselves. But perhaps a brief synopsis at this point will be useful.

A Brief Synopsis

Chapters two and three, by Professors Knop and Warner, present the views of sociologists. Knop reviews the literature of sociology and the ways in which the concept has been handled in this literature, exploring alternative interpretations of definitions and then examining contextual usages. Finally, he seeks to apply his analysis to the urban water management case. Knop's concluding sentences are worth quoting:

> It should be understood that institutional analysis, whatever the specific area, is possible only when based in a thorough theoretical understanding of the full meaning of the term in both its conceptual and its contextual usage . . . . Such an understanding is obviously problematic, both because variations in usage exist within such an individual discipline as sociology, and because thorough analysis of the functioning of institutions, given their range of types, requires collaboration across a range of disciplines (engineering, law, the social sciences, the humanities) where theoretical styles and competences vary markedly. Further, the analysis of institutional orders is one of the most demanding challenges to face the scientist because of the massive matrix of interdependencies that quickly emerges as we approach the level of specificity which enables practical and useful treatment. The simple fact is that the term "institution" represents a synthesis and summary of a wide variety of theoretical ideas . . . . Aspirations to make the concept, and others like it, more meaningful and useful are admirable and presumably essential for substantial advances in interdisciplinary problem-oriented research. But only the foolhardy would assume that to be an easy task.

In a sense, Warner takes up where Knop left off, stressing that "Effective water resources management has its roots in an understanding of the nature of institutional structure and social organization." At the same time, he deplores the fact that even elementary information about institutional structure is not available. He sets as his objective the setting forth of a framework that "could usefully guide a program of empirical study." To this end he develops a set of hypotheses regarding some of the strategic variables related to analyzing and improving institutional effectiveness. He defines "institutional structure" as referring to the forms of social organization typified by (1) importance to society, (2) having societal acceptance and legitimacy, and (3) infusion with values. This structure, he suggests, can usefully be analyzed in terms of its cultural component, its organizational component, and its interorganizational (or linkage) component.

Chapter four examines the concept of urban institutions from the perspective of public administration, emphasizing particularly a behavioral orientation. In this chapter Professor Mowitz seems at times to come close to equating institutions with organizations, but his behavioral emphasis on organizations and organizational theory lifts his discussion above that criticized earlier in this chapter. His reference to the deprecation in political science of structural approaches under the influence of behavioral and systems emphases serves as a cogent reminder of the extent to which intellectual activities are themselves shaped by modes of thought popular at particular times and in particular settings. Relying heavily on the ideas of Floyd H. Allport, Mowitz suggests that institutions consist of "portions of activities of individuals," and institutionalization is the process by which interactive behavior is prescribed or proscribed, with the objective of reducing uncertainty in multi-individual situations. In a sense he thus posits a societal

need (imperative) for institutions, and indicates that formal organizational design represents perhaps the highest stage in efforts to meet this need. He puts organization and reorganization in a context which emphasizes the relationship of the organizational decision to the behavioral context which requires it. This clearly distinguishes his approach from that criticized earlier which tends to ignore behavioral dimensions of organizational decisions. He states, for example, "Designed formal organizations are an attempt to determine self-consciously the behavior required to accomplish specific objectives which will satisfy the needs or wishes of the constituency to whom the designers are responsible." In this regard he seems to be on common ground with Warner who also stresses the importance of objectives. And, obviously, Mowitz rejects the idea that institutions are simply an "unseen hand" response to societal stimuli.

Edward R. Kaynor (Chapter five), like Mowitz, is a political scientist and like Mowitz draws on Detroit water management examples to illustrate his analysis. He is also in agreement with Mowitz in emphasizing that institutionalization is a process "imparting stability to patterns of behavioral interaction." He carries this concept somewhat further, suggesting that the extent of institutionalization may be measured by responses to change. He outlines five criteria for measuring reaction to change: (1) system development or behavior patterns and their persistence over time; (2) system change when change is warranted; (3) dependence of system on legal or managerial dictates; (4) dependence of system on individual personality; and (5) system focus on means. He then applies these criteria to a number of water situations including Boston and Detroit.

In Chapter six, Maynard Hufschmidt admits to having used the term loosely in some of his own work and then examines its utility and seeks to derive an operational definition of the term, applying techniques of logical analysis to the latter task in the context of real situations.

Of all the contributors to this volume, Vincent Ostrom (Chapter seven) has probably written most extensively on the subject of water institutions. His essay is, thus, a kind of synthesis of a number of previous articles and reports on the subject. With Kaynor and Mowitz, he emphasizes the importance of institutions as sources of what he calls "decision rules." He equates institutions with organizations, defining the latter in behavioral terms as sets of decision-making arrangements. He points out that variety in human behavior threatens the maintenance of predictable order (which is necessary to societal existence and human learning). Thus organizational or institutional decisions represent a deliberate method for ordering relationships among people, and introducing higher levels of predictability. In confronting political or governmental institutions, Ostrom stresses the coercive power which governments possess. And in considering the issues associated with governmental intervention through reforming existing or creating new institutions, he draws heavily on economic concepts of the market and market processes, and considers market failures related to externalities, common-pool or flow resources, and public goods as appropriate stimuli to institutional design. This emphasis gives focus to his discussion, but at the same time would seem to restrict the applicability of his concepts to a very particular set of problems. In my own more eclectic thinking, I have shied away from thus restricting the concept of institutionalization -- but perhaps Ostrom's approach is necessary to give the term a useful operational meaning.

In Chapter eight Leonard Zobler approaches the institutional problem from the perspective of the geographer, examining the man-land relationships and the spatial order of natural human systems. He regards institutions dynamically as the " formal and informal social mechanisms that govern individual, group, or governmental access to earth materials via private or public decision-making processes." This definition is quite compatible with those of the other contributors. He is primarily concerned, however, with the spatial arrangements of human and natural systems, and rejects the "narrowly based engineering-technologic reductionist view of the urban water resource" which fragments the analysis into separate subsets of the water management universe. Alternatively, he seeks to consider urban water problems in the context of six dimensions: mass, state, time, quality, location, and landscape. Perhaps most significant in his analysis are his questions concerning the prevailing wisdom of federal and state policy with respect to regionalization of water functions in which he suggests that linked systems managed on a smaller scale might in fact be more effective in optimizing environmental quality. He concludes his analysis with a section entitled "Recommended Guidelines for the Design of an Urban Water Quality Institution," stating "The institutional problem is clear. It is to alter the present formal and informal patterns for allocating water resources . . . and to recommend an institutional structure (organization and behavior) better adapted to the hydrologic requirements of urban-metropolitan regions." In this thrust, Zobler joins the position outlined by Lyle Craine in the Appendix to this volume where Craine, too, seeks to design institutions for specific management functions, i.e., managing the Great Lakes.

The final chapter seeks to approach the urban water management problem from a systems point of view, and in this respect has linkages with a number of other essays where the water management system was stressed. Bulkley is more deliberate in focusing on the relationships between component elements and suggests that urban water management can best be treated as complex adaptive subsystems of society, constantly changing to meet the needs of the urban situation. He then identifies the components of the subsystem as including: (1) process, (2) tension, and (3) interaction matrix. For him, institution is the output of social processes. He states that institution has evolved to provide for desired goals or objectives (cp. Mowitz's reference to the "unseen hand" in institutionalization). He points out that institution is a necessary but not a sufficient condition for his systems model. Institution may be either structure and static or established practice, custom or usage and dynamic. To illustrate his analysis, he then applies it to wastewater management in the Detroit region, joining with Mowitz and Kaynor in using this area for illustrative purposes.

A word should also be said about the Appendix in which the two papers by Lyle Craine are presented in condensed versions. Professor Craine had been invited to contribute an original essay to this volume, but prior commitments prevented him from doing so. Yet it seemed to me that his treatment of the institutional problem in the two papers was so cogent as to warrant inclusion in this volume in lieu of an original essay. With his permission, then, they were condensed by Robert Schmidt. Hopefully, we have not detracted from his main emphasis.

REFERENCES CITED

Eisenstadt, Shmuel N.
1968 "Social institutions," International Encyclopedia of the Social Sciences.

Martin, Thomas W.
1968 "Social institutions: a reformulation of the concept," Pacific Sociological Review 11 (Fall).

Chapter Two
Social Institutions: A Conceptual, Contextual, and Case Analysis

by Ed Knop

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Throughout its relatively short history, sociology has had a tendency to tantalize the hasty consumer of its wares while tormenting the more thoughtful, conscientious one. The reason for this is a complex one related partly to the intriguing but elusive subject matter broadly roped off by the discipline. Even more importantly, it would seem that the reason is rooted in the relative underdevelopment (incompleteness and "looseness") of sociology's theoretical base. To the extent that any "knowledge" is consensual acceptance of abstract conceptions of phenomena related in a way that is consistent with perceived reality, then sociology remains relatively deficient in such knowledge precisely because we lack consensus at the more abstract levels. While consensual acceptance is extensive concerning the nature and interrelationship of concrete empirical reality, the higher one climbs the ladder of abstraction, the less he finds systematic integration, consensus, and conceptual clarity, and thus "solid" knowledge. What is most needed in sociology is logical and ideological integration and completeness at the middle and upper ranges of abstraction, thus providing a systematic skeleton for the discipline's substantive content, unitizing the discipline and providing a basis for possible consensus.

If sociologists are to be condemned for their relative scientific underdevelopment, then even more to be condemned are the increasing numbers of fellow scientists who borrow both freely and naively from precisely that sociological material which is most ambiguous and underdeveloped in an attempt to solve their own theoretical or data problems. Sociologists have become such a favorite target for blame in academic buck-passing that phrases like "the human coefficient," "social dimensions," and "institutional factors" have become standard scientific cliches. Yet these are the very concepts that sociologists readily concede to be highly problematic notions at best, and generally meaningless ones at worst.

In an attempt (1) to lend insight into the practical and theoretical problems of incorporating abstract sociological conceptions into the scholarly work of other disciplines, and (2) to clarify somewhat a conceptual issue at the core of sociology's abstract confusion, this paper is given to an analysis of one of the most frequently used and confused terms in the sociological vocabulary: social institutions. Because the term crosscuts most sociological issues, reflects the most basic of conceptual and theory-integration problems of the discipline, and remains a favorite in the social science lexicon, focus on it seems an appropriate way to approach the stated objectives. As the sociological giant Florian Znaniecki has argued: "A critic of sociology could hardly find a better way of arousing skepticism of its scientific status than by collecting definitions given by sociologists of . . . 'social institution'" (1958:172). This paper is divided into three parts, the first devoted to a standard conceptual analysis of the term, the second to its application in the community context, and the third to concise analysis of selected institutions in the community water case.

Part One. An Analysis of Conceptual Meaning

The Baseline Controversy: Realism vs. Nominalism. Although the problem is not unique to the social sciences, they are probably more plagued by the realism/determinism-nominalism/indeterminism issue than are the natural science disciplines. The social sciences are unquestionably concerned with causally linked phenomena, typically in the context of comprehensive (holistic) and highly complex social, cultural, and natural systems. To this extent, there has always been considerable emphasis within theoretical sociology on the deterministic relationships implicit in social systems analysis. But for various reasons -- some ideological and some practical -- the vast majority of sociologists have simultaneously subscribed to some form of the "free will" doctrine, i.e., that human behavior is, or can be, rationally based and voluntary.

Since sociology's inception, ideological controversy has raged within it over the extent to which deterministic complexes of social, cultural, and ecological systems control men or to which men control their own personal or collective destiny by using their unique powers of rationality and understanding. Inspired probably by the philosopher's propensity for logically tight arguments based on polar assumptions, sociologists early tended to split into ideological schools around this issue. Some were inclined to give priority to the massive and evasive macro-systems' structured properties, while others emphatically maintained that the relatively free behaviors of individual men were the proper base for explaining social occurrences. Still others wandered freely back and forth between the warring camps, drawing from both as it suited their fancy, oblivious to, or not caring about, the implicit inconsistencies between their separate points of reference. The holists generally leaned heavily on deterministic organic or mechanistic models of social causality, never questioning the factual existence of such vague entities as "society," "community," "social class," or "groups" as *real things* with properties and functions more pervasive than the attributes and actions of individual persons who constituted them. Those sociologists of an individualistic or atomistic bent, on the other hand, early developed a paranoia of reification, and thus, at best, would call anything more abstract than individual behaviors "nominal constructs" -- hueristic abstractions which existed in name only. Because of this split, sociologists got into the habit of using the same terms (*society, community, group, role, norm*) to represent quite different ideas (that is, "concepts") with distinct sets of implications. During the single century of sociology's existence, the pendulum of preferred theoretical paradigm has swung back and forth at regular intervals, with the realist (system determinist) position being predominant from the World War II era to about 1960, during which time scientific sociology underwent its principal development. In the past decade there has been increasing discontent with the realist brand of sociology, resulting in

a tendency for the new generation of sociologists to prefer a more nominalistic perspective and a more eclectic theoretical treatment. The need for a sociological Newton has probably never before been so strongly felt in the discipline, as thousands of sociologists shift their synthesizing efforts upward in abstractness in the hopes of forging the long-sought unitary systematic sociology. Such an effort is reflected in the present intensified attention being given to the clarification, refinement, and integration of key problematic concepts. The term *social institution* stands as a good example: three attempts at the reformulation of the concept have appeared as free-standing articles in sociological journals during the 1960s (Martin, 1968; Smith, 1964; Kaplan, 1960), with additional attempts being made by anthropologists, economists, and political scientists.

The Place of Social Institutions in the Sociological Vocabulary. The concept of institutions is an ancient one, as are many sociological concepts. It was one of Plato's favorites, as it was a favorite among the great Enlightenment thinkers: Voltaire, Condorcet, Montesquieu, and others. The term took on a special significance, however, with the advent of sociology and its heavy reliance on organic models of society. For Comte, and for Spencer to an even greater degree, "institutions" became the basic sub-unit of which societies were composed. In their version, institutions were conceived of as actual entities taking precedence over all the more minor components to keep the whole society functioning as a healthy unit. Sometimes these institutions were likened to the major organs of the corporate social body -- the heart, stomach, brain, etc. -- but more often they were seen as cross-cutting coordinative systems analogous to the cardiovascular system, the nervous system, the lymphatic system, the muscle structure, etc. Understandably, in the hands of such scholars the most major "real" (visible) dimensions of collective life became associated with the term *institution*: government, the family (in a generalized sense), the military, organized religion, education, and so forth. The emphasis of such sociological activity was obviously upon cutting up the corporate social body into various numbers of basic sub-units so as to better observe the functioning of each in the institutional dissection of society, to which we shall return later. Briefly for now, we may summarize the original realist conceptualization of the term as follows:

1. Institutions tended to be associated with formally organized social groupings;

2. they took on the status of the main organizational and functional structure of society;

3. they were invested with the key normative qualities of the society or culture;

4. they became the primary (a) social-control, (b) adaptive, and (c) integrative sub-units of society.

The number and names of such social institutions varied with the whims and cultural biases of their creators, but all agreed that institutions were the stuff of which societies were made. As will be seen, various forms of this interpretation of the term still persists within the realist camp. Several contemporary authors argue the importance of this concept in their sociologies:

> Social institutions form the framework of society. They . . . constitute the organization of society (Chamblis, 1954:7).
>
> Institutions lie at the center of sociological attention. They constitute the main building blocks of society (Inkeles, 1964:68).
>
> . . . Institutions are defined by the fact that they are structured requisites of the systems in which they occur (Marion Levy in Martindale, 1960b:491).

However stated, the typical interpretation of institutions within sociology until the 1960s emphasized:

1. That they were the most abstract sub-units of society;

2. that they existed to serve the essential needs of the society and thus of the persons making up the society.

The institutions most often cited are the polity, the economy, the family (generalized), the legal system, religion, education, and recreation. Experience has shown that the only utility of such abstract categorical reification, even for the realist-sociologist, is that it provides headings for chapters in introductory texts.

Concerning the tendency to treat institutions in this fashion, Martindale argues:

> The major institutions were said to be those which were in fact discovered. Family, political, economic and religious institutions appeared on all the major lists . . . . Though it was evident that there is a kind of general truth in conceiving of institutions as the implementation and regulation of needs, the theory turned out to be almost useless for answering the questions which gave rise to it in the first place. For one thing the assignment of institutions to the category of needs which it was presumed to implement and regulate was not an easy task . . . . If one took the trouble to examine any single institution, it became clear that a given institution could satisfy a wide variety of needs. . . . The need theory's failure to account for institutions is theoretically clarified by the fact that human needs are not biologically fixed preconditions of human social life in the same manner as are sets of instincts in pre-human species . . . . Far from being the fundamental point from which institutions can be categorized, human needs are themselves best explained by the very institutions for which they are assumed to account (Martindale, 1966:123-124).

However ideologically important the concept has been for sociologists, it in fact has played a distinctly minor practical role in the development of the discipline and in the explanations it has offered. The reason seems to be that the term lacks consensual usage and that it is so far removed from empirical referents that it has no value as a researchable variable. The term remains in the social science vocabulary more because of its heuristic value than for any integral meaning it has in the discipline's body of knowledge. As Thomas Martin puts it, "It seems that the concept has steadily come . . . to serve as a catchword, an heuristic device, or a 'primitive term' to be used as a means for generalizing specific

research findings to the level of system operation" (1968:100). It has also become a frequent evasion technique both within and without the discipline, enabling authors to avoid more precise conceptual treatment.

Interestingly, for as central a term as *institution* is purported to be for the discipline, it is used infrequently by recent generations of sociologists, who tend to be preoccupied with conceptual preciseness and operationalizability. Of approximately two dozen recent freshman-sophomore-level sociology texts surveyed by the writer, nearly one-half did not bother to index the term, and fewer than one-half attempted to define it. Robert Hanson has found that the term was used in only 40 percent of all textbooks in sociology, social psychology, cultural anthropology, and general social science which were reviewed by the American Sociological Review from 1945 to 1956 (Smith, 1964: 205). In recent more advanced texts and professional monographs, the term is seldom either defined or used in any significant way. This is not to say that the term has been judged a bogus one by the discipline, but that it remains so problematic and ambiguous that most serious sociological writers prefer avoiding it in favor of more concrete and consensual alternatives.

Alternative Meanings of "Social Institution." While there is considerable variation in common usage of the term even within the theoretical schools of sociology, the starkest contrasts are to be found tween those of the realist and nominalist persuasions. Three summary analyses of the concept *social institution* have been published in the past decade, each paying primary attention to the realist conceptualizations. In the most recent, Thomas Martin (1968:100-102) offered the following categories of usages:

I. Institutions as Social Structures.

A. Institutions as *normative* structures.

1. An institution is an accepted standard of behavior which one learns from others and accepts as norms which govern behavior (Chinoy, 1961:22).

2. Institution refers . . . to a set of institutional (i.e., morally imperative) norms that cohere around a relatively distinct and socially important complex of values (Williams, 1959:29).

3. An institution consists of a system of social norms defining the rights and duties of individuals (Wilson and Kolb, 1949:513).

B. Institutions as *role* structures.

1. An institution will be said to be a complex of institutionalized role integrates (or status relationships) which is of strategic structural significance to the system in question . . . it is made up of a plurality of interdependent roles or components of them . . . a complex of patterned elements in role expectations which may apply to an indefinite number of collectives (Parsons, 1951:39).

2. An institution is an established pattern of conduct, or set of patterns, relating to some feature of social life (Ward, 1903:15).

3. Institutions are special types of inter-subjective systems, individuals interacting. They are not merely the collection of individuals, but the mode of behavior in which they engage (Klatsoff, 1953:22).

C. Institutions as *groups* of people.

1. An institution consists of a concept (idea, notion, doctrine, interest) and a structure. The structure is a framework, an apparatus, or perhaps only a number of functionaries set up to cooperate in prescribed ways at a certain juncture (Sumner, 1960:4).

2. An institution [is] a group of people united for the purpose of a simple or complex activity; always in possession of a material endowment and a technical outfit; organized on a definite legal or customary charter linguistically formulated in myth, legend, rule or maxim; and trained for the carrying out of its tasks (Malinowski, 1961:50).

3. An institution consists of persons or social groups who are attempting, as a joint effect, to realize a mutually held goal or idea, and behave and interact in conformity with a system of rules for conduct (Hauriou, 1956:43).

II. Institutions as Socially Functional.

A. Institutions as *units of adaptation*.

1. Institutions are mechanisms which men have established in order to secure or achieve their primary needs (Lundberg, 1938:12).

2. An institution . . . is a complex system of comparatively permanent habits, attitudes, utilitarian objects and symbolic traits which performs the function of satisfying man's needs and which regulates social life (O'Brien, Schrag, and Martin, 1957:359).

B. Institutions as *mechanisms of social control*.

1. Institutions . . . are patterns governing behavior and social relations which have become interwoven with the system of common moral sentiments which in turn define what one has the "right to expect" of a person in a certain position (Parsons, 1949:143).

2. Institutions are value patterns which govern action in a social system. They define modes of behavior "legitimately expected" and are therefore ideal but not utopian patterns (Mercer, 1956:267).

3. Institutions are established systems of rules of behavior, that is, social norms by which the group maintains, regulates, and makes more general and frequent types of action defined as

valued and desirable (Thomas and Znaniecki, 1918-20:267).

It should be noted here that Lester Ward's interpretation (I,B,2 above) is one of the two nominalist formulations in this listing, reflecting the fact that the term *role*, like *institution*, is sometimes taken to be a real structural-normative aspect of social organization (as Martin here interpreted its usage), and sometimes as nothing more than a linguistic handle for what otherwise could be called "repetitive or typical individual behaviors geared to the person's immediate circumstances" (as Ward probably intended). It would seem to have been useful if each of the three authors cited here for their analyses of the concept had isolated distinct conceptions of the term *role*, allowing the nominalist interpretation of the term *institution* to be more apparent in their treatments. The second instance of a nominalistic formulation in Martin's listing is George Lundberg's (II,A,1) interpretation, which emphasizes men's rational design in the social sphere somewhat as do institutional economists when laying out their typically more narrow and specific interpretation based in Exchange Theory. Illustrative of these points are several typical nominalist formulations which focus on the idea that institutions are relatively narrow and persistent, collectively standardized, cooperative *patterns* of rationally organized problem-solving sets of behavior.

> [Institutions are] . . . established forms or conditions of procedure characteristic of group activity . . . . An institution is not a group at all, organized or unorganized . . . . It is an organized way of doing something (MacIver and Page, 1949:15-16).

> Some forms of behavior seem repetitive, organized, standardized and, within homogeneous societies, somewhat predictable. Commonly these uniformities are called "institutions." The generic term institution is an abstraction, not a perceivable reality (John Burma in Lasswell, Burma, and Aronson, 1965:384).

> [An institution is] . . . a stable, mutually understood and accepted pattern of interhuman interaction (Martindale, 1960a:306).

While in some regards the nominalist usage is more open-ended than the typical realist usage, the nominalist tends to mean something much more narrow and concrete than the average realist does, to mean, for instance, "the procedures for getting a job" or "going about buying a car" rather than "the economy"; "ordination" or "liturgy" rather than "religion"; "monogamy" or "divorce" rather than "the family." The narrower nominalist interpretation of social institutions is becoming the preferred one among younger sociologists, as it long has been for the economist, probably because it has greater operational utility, is more consistent with the *a priori* understanding of other social scientists, and reflects a general shift in theoretical preference among sociologists.

There remains one additional interpretation of institutions that is generally implicit in both the realist and nominalist treatments. It concerns the special *integrative* role of institutions in either social systems or social behavior. Several explicit statements appear below:

> The relatively permanent, stable, uniform and formal manner in which social groups are interrelated produces what are termed social institutions (Clinard, 1963:6).

> Institutions are the relational patterns manifested by groups. Groups are organized sets of interhuman behaviors; institutions are the relationships displayed therein (Martindale, 1966:123).

> Just as [repititive] social acts may be aggregated into customs, and sets of such actions aggregated into roles, so a more complex structure of roles organized around some central activity or social need may be aggregated into an institution (Inkeles, 1964:68).

Other authors' reviews of the term's meanings are similar to Martin's. Harold Smith, for instance, sees the following separate usages of the term institution:

I. *Cultural Structure:* Institution is seen as a cluster of interrelated social norms which are associated with a nucleus of high-priority values and one or more basic human needs. [This can mean either] A. . . . social institutions as the whole range of folkways, mores and laws (or) B. . . . a set of institutional norms (versus "ordinary" norms in the sense that the former are more strongly obligatory) that cohere around a relatively distinct and socially important complex of values (1964:198-199).

II. *Systems of Interactive Relationships:* Some sociologists conceive of an institution as consisting of interactive patterns and social relationships which are characteristic of groups and social systems. This usage is focused on the persistent patterns of positions (or statuses) and the organized actions of persons coordinate with such positions. Thus when human interaction becomes sufficiently regularized, it is said to be institutional. For example, Lee states: " . . . an institution may be defined as a network of relatively continuous interhuman processes and relationships initiating and maintaining connections between persons and groups within a plurality pattern for the purpose of preserving the latter or otherwise serving its interest" (1964:200; this is a typically nominalistic statement with emphasis on the integrative aspect).

III. *Both Cultural (Normative) and Interactive Relationships (including role complexes):* (Smith illustrates this position with a quotation from E. T. Hiller:) "Institutions are complexes of ideas and practices containing norms specifying conduct between persons. So viewed, a social institution is a relatively elaborate organization of norm-regulated social relations directed toward some interest or need (Smith, 1964:200).

The same basic position is formulated alternatively by Talcott Parsons (as quoted above by Martin - I,B,1) and by Gerth and Mills in terms of clusters of role expectations and definitions as follows: "Institutions are clusters of roles anchored in an authoritative role (e.g., parental authority; the term "role" is used here in a nominalist sense, as contrasted with Talcott Parsons' realist usage)" (Martindale, 1960b:370).

IV. *Cultural (Normative) Structure and Interactive Relationships Plus Relevant Material Objects:* A large number of sociologists would give the concept institution even wider coverage than what has been indicated so far . . . . A third additional part is now added, namely, the meaning of symbols and material objects which are essential to "institutional functioning" as

the Bible is for religion and the home is for the family. F. S. Chapin argues, for instance, that an institution is: "An organized pattern of the attitudes and behaviors of the members of a group that stands out as a configuration against the field of culture . . . . In some cases material culture traits are tied into the configuration . . . ." (Smith, 1964:201).

Smith summarizes his analysis by listing the characteristics he finds delimiting the various interpretations of the term *institution* (what he calls the "common elements," representing his own interpretation). He considers institutions to be characterized by:

1. cultural norms
2. interrelated parts or structure
3. stability and persistence
4. their "functions" (what they do for men, the community or society)
5. sanctions
6. cognitive elements (meanings, definitions, beliefs)
7. regularized social interaction
8. material culture traits (1964:202-204).

An alternative cataloging of institutional attributes is interestingly and concisely handled by Howard Kaplan in his research-oriented review of the concept. He sees three groupings of conceptual treatments:

I. The first group of definitions is most often recognized as the traditional concept of institution. This group shares two ideas in common: the nature of the unit and the focus around which the units are organized. The units are variously named "forms of prescribed behavior," "rules," "attitudes and behaviors of the members of the group," "cultural patterns," or "folkways and mores." These cultural-normative patterns are focused around "a number of social functions" or "about certain fundamental needs that occur in all societies and are necessary to ordered social life" (1960:176).

II. In . . . another class of definitions of institutions . . . the concept is generally defined as an organized group (particularly, relative to community functioning) (1960:177).

III. A third group of definitions of institutions allows us to treat the institution as a complex of status-role relationships . . . (1960:178).

In his critical review of the difficulties embodied in each of these categories of definitions Kaplan offers his own interpretation, tailored, he believes, to the empirical researcher's needs:

> An institution may be defined, then, as a complex of status-role relationships which is concerned with a particular area of activity within any specified social system (total or partial). The statuses making up the institution must have the following characteristics if they are to be considered as part of the institution in question. (1) Statuses must be socially recognized and defined (in terms of normative expectations . . .; (2) The statuses must exist independently of the people who occupy the statuses (giving it continuity over time) (1960:179).

Associated Conceptual Distinctions. Before I attempt a summary restatement of the concept *social institution*, it will prove helpful to review several associated concepts and distinctions. The most important of these is the concept *institutionalization*, which has, surprisingly, enjoyed relatively precise and consensual interpretation among all sociologists:

> Through institutionalization, human behavior is made predictable and patterned, social systems are given the elements of structure and the process of function. As each invention or practice is accepted . . . institutionalization of relationships concerning it takes place . . . . Much of what [is] called institutionalization may (alternatively) be called systemic linkage (that is, being systematically keyed to or integrated with other aspects of the social unit) (Loomis and Loomis, 1956:6 and 84).

> Institutionalization is the process whereby certain patterns of behavior become legitimized . . . (Inkeles, 1964:33-34).

> By institutionalization we mean the integration of expectations of the actors in a relevant interactive system of roles with a shared normative pattern of values . . . . Actions are said to be institutionalized if the actors expect them to occur and there are cultural sanctions opposing non-conformity . . . . (Parsons and Shills, 1951:20 and 40).

> In what is perhaps its most significant meaning, 'to institutionalize' is to *infuse with value* beyond the technical requirements of the task at hand . . . . The test of infusion with value is *expendability* . . . . When value infusion takes place . . . there is a resistance to change (Selznick, 1957: 17-19).

> By institutionalization, we mean the process by which new ideas and functions . . . are integrated and fitted into . . . societies, are accepted and acquire the capacity to sustain themselves, and, in turn, influence the larger environment in which they function" (Esman and Bruhns, 1966:321).

Either explicitly or implicitly, each of these definitions (purposely drawn from variant theoretical camps) emphasizes the following notions:

1. Institutionalization is the process by which fairly specific things (ideas, expectations, behavior patterns, material objects) become (A) widely accepted, (B) invested with social value, and (C) normatively legitimated.

2. A key aspect of this process is the integration of the thing into the general social order.

3. The consequence of the process is that institutionalized things acquire the quality of persistence (primarily because of their interdependency relationships).

If only the sociological giants had long ago proclaimed that "that which has been institutionalized is an institution," the general problem would have been solved. For some reason, however, only those in the minority nominalist camp were inclined to move in this direction, and then only in an indirect and incomplete

fashion.

Another concept which has long been associated with the nominalist interpretation of institutions, but which for some reason did not become common until the last decade, goes by the alternative names *institutional complex, institutional order,* or *institutional sector.* This provides the nominalists with a way of eventually working up to such massive, complex, and abstract concepts as education, religion, government, and the economy, allowing them to make occasional reference to widespread coordinated activities (such as government) without destroying the manageability of their more narrowly conceived term *institution.* Alex Inkeles is one of the few realists who takes a somewhat similar tack with his distinction between large-scale institutions (such as government) and small-scale ones (such as a local fraternity chapter).

Another distinction is made by both the realists and nominalists in their dichotomous ranking of specific institutions or institutional sectors in terms of their relative importance to the people or the system. In antiquity Karl Marx made much of the "basic" or "substructural" institution of the economy to which the secondary or "superstructural" institutions were keyed. Russel Dynes and others speak of "dominant institutions" (1964:379), Marion Levy speaks of "strategic institutions" (Martindale, 1960b:491) and Don Martindale of "primary institutions" ("We may describe as 'primary' those institutional areas of inter-human life that immediately serve the basic human requirements: the control of human impulses and the supply of those things necessary for human life") (1960a: 307).

Of frequent consideration in sociological discussions of institutions, particularly in the context of problematic social situations, are such concepts as *inter-institutional inconsistency* -- "mutual inconsistency or contradiction of traits" yielding insufficient consensus to keep all or most of them viable (Stuart Queen in Lee and Lee, 1955:33) -- and *institutional conflict* -- long-established major social collectives engaged in fierce competition for limited resources required or desired by each for its own maintenance (Dynes, 1964:380). Dynes writes of two institutional characteristics which work to resolve such problematic relations: (1) "institutional dominance," where some institutions are generally construed to have priority over others, requiring constraint or alteration of the more minor until a reconciliation is achieved (he lists six points for the working dynamics of such reconciliation), and (2) "coordination of elites," where key representatives of the respective institutions work out mutually agreeable arrangements to coordinate relations or resolve conflicts (1964:380). Two additional processes may be added which serve to resolve institutional clashes: (1) the creation and utilization of adjudicative institutions endowed with authority or power to resolve the problem, and (2) the institutionalization of informal procedures for keeping separate intrinsically inconsistent behavioral patterns or hostile groups (double standards, role separations, and the like).

Two final associated concepts, of forgotten origin, are *institutional alternatives* and *local versus translocal institutions.* With regard to institutional alternatives, all that needs to be noted here is that several or many substitute institutions, which may occur either simultaneously or sequentially, can provide the same essential function for the needs of either the social system or the people who occupy it. With respect to local versus translocal institutions (implicitly, at the community or sub-system level), we must recognize that many institutions may take unique forms in given settings (that is, serve as functional alternatives across social units), or may be the same or highly similar across specific settings, thus appearing to be universal or societal institutions.

In an attempt to pull the foregoing together, we may note:

1. The typical realist conception of the term *social institution* makes it the broadest and most abstract structural, normative, and functional sub-unit of society, tends to equate or associate it with the structure of functionally important social groups, and attributes to it special powers of persistence and social control.

2. The typical nominalist conception of the term reduces its level of abstractness to mean any persistent collectively standardized and coordinated pattern of rationally organized problem-solving behavior, and to associate it with the interrelated activities of persons in or between groups, but not to equate it with the group, the group's structure, or more abstracted social structure.

3. The common ingredients of these two interpretations appear to be the beliefs that: (1) institutions are widely accepted, are thought to have social value or utility, and are afforded legitimacy; (2) institutions are characterized by their integrative or interrelated nature; and (3) institutions have strong tendencies to persist. These are the only general attributes the nominalists and realists are both inclined to associate with the term *institutionalization.*

If, as rigorous scholars and scientists, we can tolerate such a wide and loose range of referents as is implied in the common-ground interpretation (point 3 above) -- varying from Smith's material objects through Martindale's standard problem-solving group activities to Kaplan's organization of functionally related sets of status-role relationships (a frequent definition of group structure) -- then to do so seems the logical course, for it would at least provide us with ready conceptual consensus. If, on the other hand, we cannot afford such latitude in referents, then the nominalist conceptualization seems the preferable one for both the researcher and the theorist, since this interpretation has greater manageability, specificity, and operationalizibility and is complemented by a range of auxiliary concepts (*institutional sector, institutional alternative, inter-institutional inconsistency,* etc.) enabling it to perform a range of wonders.

This author is in agreement with Thomas Martin, who concludes:

> . . . the concept of institution is an extremely valuable analytical tool, but it must be constantly redefined and specified at both the theoretical and empirical levels. Through such redefinition the concept has the potential of becoming a strategic linking device by means of which vast amounts of work in organizational analysis, role theory, group research, community study, and the like can be combined into a single body of social theory and knowledge (1968:108).

Part Two. Contextual Meaning: The Community Setting

The foregoing has approached the meanings of the term *institution* by exploring alternative definitions. Effective tests of meaning, of course, are supplied not by definitions, but rather by way of contextual usage. Therefore, we now turn attention to using the term, along with other key concepts, in the context of community (the most micro social unit generally appropriate for institutional analysis).

A Theoretical Preface to Institutional Emergence. The context of social forms' creation is the group -- "that system or pattern of social behavior which arises when pluralities pursue their individual and collective aims in common" (Martindale, 1962:38). Through interaction based on personal similarities, men order their behavior, thus forming groups; and in groups men benefit from others' experiences and orientations. Men quickly learn that common, like, or reciprocal problems can best be resolved by cooperative planning and action. Thus they are pragmatically inclined toward mutual facilitation and group association for the satisfaction of their individual desires, which need not be the same or even similar.

Just as the individual tends habitually to repeat successful solutions in standard situations and to generalize response patterns to similar situations, so, too, will groups of men repeat successful group responses to similar situations. These mutually supporting individual response patterns become the performance of complementary roles. When these "standard solutions to the problems of collective life" (Martindale, 1962:39-40) are keyed to the community context, they are termed institutions. They are complexes of reinforcing, individually patterned behaviors. To facilitate successful action in the community, the regularly occurring component patterns are reinforced by individual expectations that they persist. Such expected behavior patterns are termed *norms* if they are situationally based and aimed at all or a wide range of community members, and *roles* if they are aimed at the incumbents of select status categories. The fusion of expectational dimensions and behavioral dimensions (such as established social solutions or institutions) can be called the culture (or subculture) of those persons to whom they apply.

Emergent behavior patterns are always keyed to situational contexts that include the physical setting as a significant dimension. Thus, when men meet in a new setting and set about creating new social forms which make possible a collective life, the products can be expected to be as unique as the combined uniqueness of the setting and the individuals' respective repertoires of pre-made solutions. Regardless of the setting, however, there are certain general classes of problems which men must solve before sustained collective life is possible, and which invariably demand group action for resolution. There are two broad categories of individual concerns and thus of community institutions. One, their *private reasons*, refers to individual needs for (1) physical sustenance and (2) socio-emotional comfort and supplies part of the impetus for men to form and maintain communities. A second general category of men's concerns, and thus of institutions they create, is that of social control, required when people live in close proximity. This is their *public reason* for forming and maintaining communities. Martindale concludes: "There are no grounds for assuming that solutions to the problems in any one of these areas are any more fundamental than the solutions to those in any other." And importantly, once they are established, the sets of solutions tailored to each area, he continues, "define both the circumstances of socially significant innovation . . . and the areas of resistance to innovation" (Martindale, 1962:44).

Implicit in the foregoing is a key fact of collective life that will be elaborated below: various patterned solutions to recurrent problems must, overall, be either supportive or complementary; when they clash, the delicate -- and requisite -- interinstitutional balance or integration is endangered.

The Maintenance of Established Social Forms. Socialization is a main mechanism by which established social forms, such as institutions, are maintained. Basic socialization provides children with a working knowledge of the ways of life in their community, class, ethnic group, etc.; and continuing socialization reorients immigrant adults to the patterns characteristic of the community.

Similarly, certain characteristics of the people's culture both promote and facilitate maintenance of established patterns. Given men's dependence upon predictability in action situations -- possible only because of behavioral consistency or patterning -- they construct proscriptions and prescriptions to ensure the maintenance of these patterns. Thus sanctions -- positive and negative collective reactions to extraordinary individual behavior -- are specifically intended to encourage adherence to the established patterns by rewarding outstanding efforts toward this end and by punishing deviants whose behaviors threaten to undermine the established ordering of relations. Sanctions are, thus, the teeth in a people's shared morality or ethos. In these ways social control is obtained so that established patterns are maintained.

It has been posited above that every system of patterned social relations is keyed to an external environment, which is here called the "contingent milieu." The interrelation between the natural setting (including climate, resources, and biological ecology) and social patterns has already been noted. A second dimension of the contingent milieu that is of particular importance in this context is the interdependent nature of the relations of men in one community with those in others. Virtually every community has extensive "linkages" (or connections) with other collections of men outside, and what these other men do frequently has major consequences for local ordering. Thus, any given set of patterned social relations is contingent on both the local natural milieu and the external social milieu, with major changes in either probably affecting the local social patterning. For this reason, men attempt to maximize their control over nature by scientific and technological research and development. Also for this reason, men attempt to exert certain controls on outsiders' behavior, so that local patterns can persist without external interference (as with balance-of-power politics and legislative and secondary control organizations like the U.N., national, and state governments). And also for this reason, one of the major factors in the maintenance of established social patterning involves the incorporation of adaptive mechanisms within the local ordering: ancient men consulted oracles for new dictums in times of crisis; established governing bodies enact new laws or give old ones new interpretations as situations become altered. While adaptive mechanisms do not preserve social ordering exactly, they allow it to remain as much as possible like the precedent form, with the alterations occurring in acceptable ways. Too, when external linkages give evidence of causing internal trouble, there is a tendency for men to advo-

cate contracted linkages or increased local autonomy and self-sufficiency -- the isolationist tendency.

Two final points regarding the maintenance of social patterns rest upon the assumption that men have an emotional vested interest in established social patterns. If they had a hand in their creation or revision, they want to see the products of their efforts maintained. And because all men require the psychic nourishment provided by emotionally satisfying social relations, they have a deep vested interest in the preservation of patterned affective and expressive social forms. These, when they do not exist independently, are typically superimposed on instrumental patterned relations, and thus men are inclined to permit no tampering with them.

The Community as an Institutional Complex. The patterning process discussed above yields a variety of institutional forms varying from production-oriented and peace-keeping ones to adaptation and linkage patterns. It is a convention among many sociologists to consider this whole local institutional complex as synonymous with the term *community*. Several definitions exemplify this practice.

> A community is a complete system of social interaction, that is a set of social groups sufficient to solve for a plurality of individuals all the problems of collective life falling into the compass of a normal year and in the compass of a normal life . . . . The problem with which the theory of (community) attempts to cope concerns the interadjustment of the institutions of one area of social life to influences arising out of another (Martindale, 1962:44). The concept community has become important not as a term for an area where people live but for a kind of integrated system of social life in which geographic area is secondary or even irrelevant (Martindale, 1960b:133).

Harold Kaufman concurs, and elaborates:

> The community may be seen as a network of interrelated associations, formal and informal, whose major function is problem solving for the local society . . . . The community may be seen as a problem-solving process which provides needed adjustment for the local life . . . . Discrete unrelated actions, no matter how great their individual contributions, do not make the interactional community. A degree of coordination, integration, and unity is essential. This is realized . . . through groups which coordinate and carry out community activity. At the cultural level, integration is affected through the widely shared values and objects pertaining to the community field, and at the ecological level, through a 'functional relation' of services (Kaufman, 1959:12).

As defined above, a community is a system of social action sufficient to solve for a collection of people all the problems of collective life typical in a normal year and in a normal life. It is the largest usual or primary interactional network in which a number of persons participate for the satisfaction of their common daily productive, consumptive, and socio-emotional needs; its limits are the practical limits in which the individual lives out his mundane day-to-day life. It is within the community that primary interactions intersect with the more artificial and formal secondary institutions. While the family is the prime agency of socialization, it is the community that in large part defines the appropriate norms, values, aspirations, etc., which make up the content of that socialization. This is not to suggest that communities are strictly homogeneous units; rather, they are the basic units of heterogeneity with which any given individual has first-hand familiarity.

Part Three. Toward an Analysis of the Urban Water Management Case

Given that communities are comprised largely of a massive matrix of reciprocal and overlapping institutional patterns, it is difficult to dissect analytically any set of these without reference to numerous others with which they are functionally linked. Practical constraints, however, dictate that this brief exemplary discussion be concerned with a summary of selected institutional interfaces in a relatively limited institutional complex, of which urban water management problems will be made the focus. It will become immediately apparent, none the less, that this seemingly narrow sector of community institutions is, in fact, highly diffuse and pervasive in the total community institutional network.

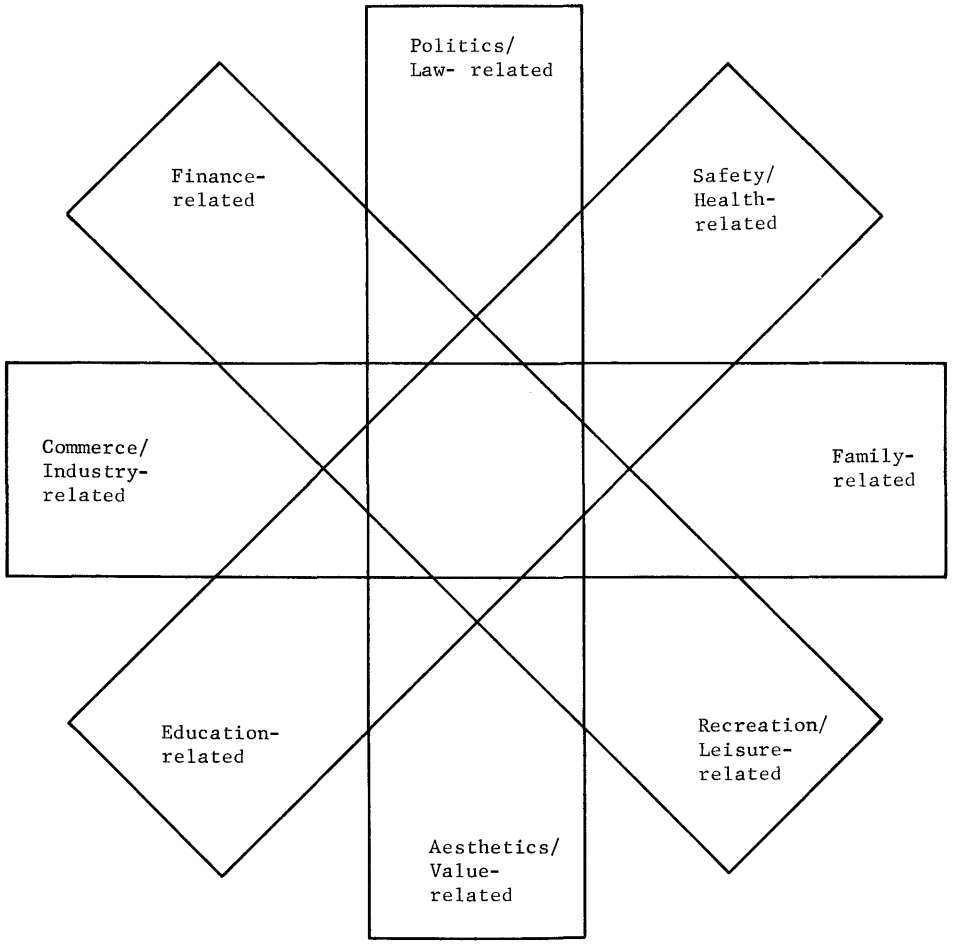
In an attempt to interject some order into the complex matter of institutional mapping and analysis, overly simple general categories of community-life sectors will be offered and divided into selected institutional areas that have clear implications in the context of water management. For each of these institutional areas one or more examples of specific institutional patterns will be noted. It should be understood that the community sectors, the general institutional areas, and the specific institutions identified are not intended to be comprehensive, or even representative, listings, but are rather chosen to provide a range of examples for analysis.

To illustrate the reciprocity and overlap of institutional complexes associated with general community sectors, Figure 1 is offered as a brief heuristic paradigm (obviously arbitrary and selective in sector identification).

A sampling of water-related institutions is made by general categories and subcategories in Table 1, and each is accompanied by an example of a specific relevant institution. It should be noted that a more usual way to approach the listing of such a series of institutional patterns would be to first identify and delineate the specific water-related organizational-institutional sets (such as systems of water supply, control, distribution, utilization and reclamation), and then to relate each specific component to broader functional sectors of the general community social system (governmental, financial, educational, etc.). An alternative cataloguing procedure is followed here to emphasize the complexity of relating water institutions to these broader sectors of community organization, although such a listing obfuscates the interrelations between water-management patterns.

Figure 1

Gross Paradigm of Selected Community Institutional Sectors of Significance to Urban Water Management



A sampling of water-related institutions is made by general categories and subcategories in Table 1, and each is accompanied by an example of a specific relevant institution. It should be noted that a more usual way to approach the listing of such a series of institutional patterns would be to first identify and delineate the specific water-related organizational-institutional sets such as systems of water supply,

Table 1:

Examples of Water Use Institutions by Institutional Area and General Community Sector

Category	Specific example of patterned problem-solving process/practice
Safety/Health	
Flood control systems	Process of surveying drainage areas for construction of diversion ditches
Waste treatment systems	Procedure for sewage collection, processing, and disposal
Fire control systems	Process for regularized inspection and maintenance of hydrant delivery systems
Clean water delivery systems	Procedure for supplying clean drinking water in disasters and after contamination of public water supplies
Political/Legal	
Citizen group lobby practices	Precedent of petitioning procedure to bring pressure on civic leadership
Water storage procedures	Process of maintaining public reservoir systems
Regulation of volume usage	Practice of imposing use limitations in times of draught
Water rights law	Process for court adjudication of disputed claims
Pollution control	Practice of offering variances to serve greater public interest
Financial	
Water procurement financing	Bank loan practices for private and industrial deep-well drilling
Public bonding	Procedures for public borrowing for treatment facilities construction
Cost regulation of water use	Practice of flat-rate domestic assessments to encourage lawn watering, etc.
Commercial/Industrial	
Water need assurances	Practice of purchasing water rights prior to industrial location or expansion
Conservation systems	Procedures for implementation of water recycling technology
Fluid emission treatment	Practice of cooling heated water before discharge into rivers and lakes
Consumer-interest orientation	Practice of advertising products through appeal to their water-conservation attributes
New technology	Federal granting practices for development of practical conservation-oriented consumer products (such as chemical toilets)
Family	
Hygiene needs	Bathing practices and related social norms
Maintenance of properties	Practice of washing automobiles
Convenience technology	Prevalent use of dishwashers, etc.

Table 1 (cont'd)

Category	Specific example of patterned problem-solving process/practice
Aesthetic	
Ecology movement	Practice of organizing to increase sensitivity and to explore options for aesthetic preservation
Retreat areas	Practice of maintaining public parks, scenic lagoons, etc.
Tastes	Practice of extensive lawn watering, reflecting preference for green growth
Recreational	
Public facilities	Practice of constructing and maintaining public swimming pools
Multiple-use storage systems	Process of developing reservoirs and waterways for both sporting and water-storage purposes
Water purity	Practice of setting pollution standards at level where existent water life is not jeopardized
Educational	
Hygiene emphasis	Practice of school shower-daily programs in conjunction with physical education courses
Formal sensitivity programs	Practice of devoting sections of courses throughout grade levels to water-use sensitivity experiences
Mass Media	Procedures for influencing public opinion about water use through news and documentary programs

A minimum of imagination is required to appreciate the complex interrelationships between a specific institution in one institutional sector and other institutions in that sector, and in other sectors as well. A single example should suffice. Legal statutes regulating permissible levels of effluent-discharge contamination are integrally related to all of the following examples (and still others are possible, of course): aesthetic and recreational preferences and practices, sensitizing programs in schools and via the mass media, industrial treatment processes, governmental inspection and complaint actions, public adjudication processes, and financing improved treatment processes. In short order, a considerable number of functionally related institutional subsystems become implicated. Such is the nature of interdependent institutional complexes, which, when taken collectively, yield a relatively well-functioning and integrated community. The greater the interdependence, of course, the greater the long-range structural effectiveness and stability of the community and the greater the citizen's social-psychological sense of "community" (solidarity, feeling of belonging, sense of mutual trust and good will).

Two sets of related analytic comments, then, are in order. One concerns what may be thought of as distinct types of institutions dependent upon their technological and value implications. (1) Some of the institutions above are pretty much a matter of the management of processes now relegated to material technology (man's use of mechanical processes to extend the effectiveness of his human capabilities), as in recycling industrial effluents; (2) some are more a matter of social technology (man's ways of managing his collective social relations), as with the procedures for obtaining loans and permits for drilling wills, or using court procedures for settling disputed use rights; and (3) some are of the order of common practices reflecting aesthetic and normative preferences of people (making them both social-psychological and cultural), as with watering lawns and enjoying scenic lagoons.

Another, but related, set of distinctions apparent in the above examples has to do with behavioral patterning: (1) regularizing the ways water is actually used in human problem-solving efforts, as contrasted with (2) institutionalizing procedures which serve to regulate problematic usages of water. Relying on a basic distinction presented in Part II, we can classify institutions as those (1) existing to satisfy men's sustenance or consumptive needs, whether *physical* (having clean water to drink or to enable an industrial process which provides essential employment) or *socio-emotional* (having lakes to put boats on or lagoons to look at); or (2) those existing to satisfy men's collective social-control needs, through either the socialization of internalized self control (the functioning of the family, education and the mass media) or sanctioning procedures (the political and legal processes, social pressures, etc.).

While these sets of distinctions are not intended as formal typologies of social institutions, they do serve to underscore points treated throughout the paper which suggest several concluding comments. It should be understood that institutional analysis, whatever the specific area, is possible only when based in a thorough theoretical understanding of the full meaning of the term in both its conceptual and its contextual usage (Parts I and II, respectively). Such an understanding is obviously problematic, both because variations in usage exist within such an individual discipline as sociology, and because thorough analysis of the functioning of institutions, given their range of types, requires collaboration across a range of disciplines (engineering, law, the social sciences, the humanities) where theoretical styles and competences vary markedly. Further, the analysis of institutional orders is one of the most demanding challenges to face the scientist because of the massive matrix of interdependencies that quickly emerges as we approach the level of specificity which enables practical and useful treatment. The simple fact is that the term "institution" represents a synthesis and summary of a wide variety of theoretical ideas from across the social sciences and encompasses a range of substantive ideas from an even greater number of disciplines. Aspirations to make the concept, and others like it, more meaningful and useful are admirable and presumably essential for substantial advances in interdisciplinary problem-oriented research. But only the foolhardy would assume that to be an easy task.

REFERENCES CITED

Chambliss, Rollin.
1954 Social Thought. New York: Holt, Rinehart and Winston.

Chinoy, Eli.
1961 Society. New York: Random House.

Clinard, Marshall B.
1963 Sociology of Deviant Behavior. New York: Holt, Rinehart and Winston.

Dynes, Russel, et al.
1964 Social Problems: Dissensus and Deviation in Industrial Society. New York: Oxford University Press.

Esman, Milton, J. and Fred C. Bruhns.
1966 "Institution building in national development." In Comparative Theories of Social Change, Hollis W. Peter, ed. Ann Arbor: Foundation for Research on Human Behavior.

Inkeles, Alex.
1964 What is Sociology? Englewood Cliffs: Prentice-Hall.

Kaplan, Howard B.
1960 "The concept of institution: a review, evaluation, and suggested research procedure." Social Forces 39 (December): 176-180.

Kattsoff, L. O.
1963 Design of Human Behavior. Englewood Cliffs: Prentice-Hall.

Kaufman, Harold.
1959 "Toward an interaction concept of community," Social Forces 38 (October): 9-17.

Lasswell, Thomas E., John Burma, and Sidney Aronson (eds.).
1965 Life in Society. Chicago: Scotts Foresman.

Lee, Elizabeth B. and Alfred M. Lee.
1955 Social Problems in America. New York: Henry Holt and Co.

Loomis, Charpes P. and Zona K. Loomis.
1965 Modern Social Theories. Princeton: D. Van Nostrand.

Lundberg, George A.
1938 Foundations of Sociology. New York: Macmillan.

MacIver, Robert and Charles Page.
1949 Society. New York: Rinehart.

Malinowski, B.
1961 The Dynamics of Culture Change. New Haven: Yale University Press.

Martin, Thomas W.
1968 "Social institutions: a reformation of the concept." Pacific Sociological Review 11 (Fall): 100-109.

Martindale, Don.
1960a American Social Structure. New York: Appleton-Century-Crofts.
1960b The Nature and Types of Sociological Theory. Boston: Houghton Mifflin.
1966 Institutions, Organizations and Mass Society. Boston: Houghton Mifflin.

Mercer, Blaine.
1956 The American Community. New York: Random House.

O'Brien, Robert W., Clarence C. Schrag and Walter T. Martin.
1957 Readings in General Sociology, 2nd edition. Boston: Houghton Mifflin.

Parsons, Talcott.
1949 Essays in Sociological Theory. Glencoe: Free Press.
1951 The Social System. Glencoe: Free Press.

Parsons, Talcott and Edward Shills.
1951 Toward a General Theory of Action. New York: Harper.

Selznick, Philip.
1957 Leadership in Administration. New York: Harper and Row.

Smith, Harold E.
1964 "Toward a clarification of the concept of social institution." Sociology and Social Research 48 (Winter): 197-206.

Sumner, William G.
1960 Folkways. New York: Mentor Books.

Thomas, W. I. and Florian Znaniecki.
1920 The Polish Peasant in Europe and America. Chicago: University of Chicago Press.

Ward, Lester F.
1903 Pure Sociology. New York: Macmillan.

Williams, Robin.
1959 American Society. New York: Alfred A. Knopf.

Wilson, L. and W. Kolb.
1949 Sociological Analysis. New York: Harcourt Brace.

Znaniecki, Florian.
1958 "Social organization and institutions." In Georges Gurvitch and Wilbert Moore, eds. Twentieth Century Sociology. New York: Philosophical Library, 172-217.

ADDITIONAL REFERENCES

Bates, Frederick L.
1960 "Institutions, organizations and communities: a general theory of complex structure." Pacific Sociological Review 3 (Fall): 59-70.

Hanson, Robert C.
1958 "Institutions." In Joseph S. Roucek, ed., Contemporary Sociology. New York: Philosophical Library, 64-86.

Hertzler, Joyce O.
1938 "Culture contact and institutional change." In E. B. Reuter, ed., Race and Culture Contacts. New York: McGraw-Hill, 48-56.
1946 Social Institutions. Lincoln: University of Nebraska Press.

Hughes, E. C.
1942 "The study of social institutions." Social Forces 20 (March): 297-307.

Panunzio, C.
1939 Major Social Institutions. New York: Macmillan.

Chapter Three
Institutional Effectiveness and Accountability In Water Resources Management

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Effective water resources management has its roots in an understanding of the nature of institutional structure and social organization as much as in the nature of physical science and technology. Management is an organizational problem.

Nevertheless, agencies supporting research and development have failed to invest anything close to the necessary funds for studying this part of the problem. The consequence is a familiar one in our society: developments in the physical sciences and engineering technology of the problem have far outpaced those in social planning, policy, and organization.

Although detailed information has been accumulated on such matters as the properties of water, flood zones, dams, treatment plants, and siltation, the most elementary information about institutional structure is unavailable. For example, there is no adequate census and catalogue of institutional structures relating to water resources. We do not know how many there are, what they consist of, where they are, what outcomes they produce, or who benefits from them. Something is known about these matters, to be sure, but far too little for us to comprehend the more complex and central issues of institutional effectiveness in water resources management.

The purpose of this essay is to outline and discuss some of the fundamental ideas about which we need considerable further study if we are to understand the institutional structure of water resources management. I will attempt neither to review the range of publications dealing with the concepts of organizations and institutions and their effectiveness, nor to distill the "essence" of previous analyses. Nor will I attempt to summarize what is known about the institutions relating to water resources.

Instead, I will try to set forth a framework that could usefully guide a program of empirical study in this area, and to suggest a "theory" or set of hypotheses regarding some strategic variables to be examined in analyzing and improving effectiveness in institutions generally. This general conceptualization is applicable to, but not unique to, the analysis of the institutional structure of water resources management. In doing this I will briefly delineate some of the elements of a theoretical perspective on the concepts of organization, effectiveness, accountability, and institutional structure.

ORGANIZATION, EFFECTIVENESS, AND ACCOUNTABILITY

The basic function of organization is to attain collectively some desired state of affairs. A distinctive ingredient of organization is purposiveness, the object of which is to identify and agree upon desired outcomes, and to make the actual outcome of collective efforts correspond reasonably closely to the desired outcome.

The characteristic problems of organization are agreeing upon the desired outcome, understanding the means that will yield it, and designing and implementing methods for coordinating and controlling individual activities to yield an approximation of the desired results.

But the problem of water resources management cannot be dealt with adequately at this level of abstraction. It is necessary to explain what organization consists of so that the relevant phenomena can be identified and studied in relation to the specific features of water resources.

C. S. Mills gives us insight into the need for organization in his discussion of the conditions under which men make their own history. His concept is a kind of "marketplace theory" of fate or inevitability, where "innumerable decisions of innumerable men" result in unintended outcomes (Mills, 1959:181-183).

Organization is the opposite of Mills's concept of fate or inevitability (Warner, 1971:96-97). Using Mills's concept, we can identify the following key attributes of organization:

1. *identifiability*: the identifiability of the people involved, especially those having the power to control the outcome;

2. *power*: sufficient power to affect the outcome of the collective efforts of those persons participating in the organized activity;

3. *foresight*: the ability to foresee the consequences of decisions and actions;

4. *accountability*: the ability to hold those identifiable people accountable for the decisions, actions, and outcomes over which they have power and which they are able to foresee.

These are not the only attributes of organization, but they do comprise a nucleus of necessary elements. Without any one of them, man's capacity to produce through the coordinated efforts of many people a product which requires joint effort, and in which desired and actual results correspond closely, is likely to be severely limited.

Effectiveness, or some degree of correspondence between intended outcome and actual outcome, is an intrinsic part of this concept of organization. Hence, if there is no effectiveness there is little or no organization. I recognize that this conceptualization is narrow in some important ways.* For example, it

* The conceptualization of organizational effectiveness has been an area of some controversy. Views which focus on factors other than those of most concern in this paper are represented in Ghorpade (1971). I recognize that there are more factors involved in effectiveness than those outlined in this paper, but I believe these are the most fundamental.

would be possible to coordinate and control the activities of numerous people in programs that are based on faulty cause/effect presumptions, and for that reason fail to obtain a close correspondence between desired and actual results. Therefore, it is probably more precise to say that I am dealing with the concept of *effective* organization. In that sense effectiveness is an intrinsic part of the concept; it is there by definition.

Accountability is in the same sense an intrinsic part of organization. That is, for organization to exist and to have some degree of effectiveness, it must be possible to identify and hold accountable the people who have the power to control the consequences of the organizational efforts. Accountability most clearly pertains to responsibility for outcomes when the persons have control and are able to foresee the consequences of actions. However, a more dynamic view of accountability would include responsibility to develop the capacity to foresee such consequences.

Indeed, a major function of administrative leadership is the development of capacity to foresee consequences of alternative choices. In turn, such a capacity must take its meaning from the ability to identify the mission and purposes (desired outcomes) of the organization. In logical order, then, administrative leadership discharges its distinctive responsibilities when, among other things, it (1) identifies the mission and purposes of the organization, (2) develops and exercises the capacity to foresee the consequences of alternative structures and processes or actions, and (3) mobilizes the power (control) and resources to implement the structure and processes that will yield the desired consequences. In more specific terms, then, accountability pertains to each of these three foregoing categories of action. These are some of the general kinds of things administrative leadership is accountable for.

The foregoing three general categories of administrative responsibility also identify crucial areas of needed research. Previous organizational studies have shown repeatedly that organizations, especially those having any significant portion of nonmaterial outcomes among their purposes, have chronic difficulties handling each of those three general problems. Major contributions to understanding water resources management could be made by describing and analyzing the institutional structure of such management in terms of those three problems.

INSTITUTIONAL STRUCTURE

Social organization takes a variety of forms, ranging from small, sporadic, or intermittent informal groupings of people to huge, highly formalized, and explicitly regulated bureaucracies. By institutions and institutional structure, I mean forms of social organization that have the following general characteristics:*

1. relative importance in society;

2. societal acceptance, establishment, and legitimacy;

3. value infusion.

Although there is no definitive catalogue of what kinds of things qualify as "relatively important in society," traditionally we use the term *institutional structure* to refer to such central aspects of organization as those relating to government, family, education, religion, and the economy. This list expands into health, welfare, and cultural spheres. For the most part, this importance to society depends on basic functions thought to be the "core" of society, the common "needs" to which all societies give priority.

A second aspect of institutional structure is the ideas of acceptance, establishment, and legitimacy. A new way of doing things, a social movement, or an organization may begin outside the institutional realm and later come to be accepted and legitimized, either by incorporation into the value structure or by a change in the value system to accomodate the new form.

The third characteristic of institutional structure is the "infusion of value." Selznick (1957:17-22) has discussed this phenomenon, pointing out that an organizational structure may begin as an instrument for the attainment of some objectives. But as the organization gains acceptance and legitimacy, it may come to be valued for itself, independent of its instrumental value. A test for this value infusion, he points out, is expendability -- whether the organization can be disbanded when its objectives are reached or a better instrument becomes available.

Singly these three characteristics neither describe very completely the nature of institutional structure nor comprise a rigorous definition of what institutions are. But taken together they do help to separate institutional social structures from noninstitutional ones and to describe some general attributes of the kind of organization of concern in this essay.

Institutional structure has three major components:

1. *The cultural component:* established ways of doing things, norms, and roles;

2. *the organizational component:* established, formal organizations;

3. *the interorganizational component:* organizations linked with each other with some degree of structure.

The Cultural Component of Institutional Structure

The cultural component is comprised of a general foundation on which specific organizations in society are built, and a societal context that orients and constrains what groups and organizations, as well as individuals, do. It contains such things as norms, roles, values, and goals, those things which give a generalized, diffuse organization to human behavior. The most familiar and dominant form of the cultural component is law. Through the formation and enforcement of law, a certain degree of structure is imposed on the behavior of large numbers of people in society. Law, like other kinds of norms, introduces order by prescribing certain kinds of actions and proscribing other kinds. Roles introduce order by prescribing

* For some of the numerous and sometimes divergent views of "institutions" and some of their elements see: Broom and Selznick (1963:250-254); Bierstedt (1957: 298-306); Williams (1960:30-35); Selznick (1957:5-22); Kaplan (1960); and Clark (1956).

expected patterns of behavior, usually in conjunction with related roles. That is, a role assigns a person a certain "package" of rights and obligations indicating how he is to act toward certain other people and how they are to act toward him. Goals introduce order by which to judge priorities.

The cultural component of institutional structure functions in three important ways. First, it helps pattern the behavior of large masses of people. Second, when this form is internalized, it coordinates to some degree the actions of masses of people without external surveillance and sanctions, though institutional norms and values are sufficiently important that surveillance and sanctions, usually both formal -- by the agencies of societal control -- and informal -- by the influence of those who have internalized the cultural elements and who support and defend them -- are used. Third, the cultural component of institutional structure provides an integrative framework for helping to hold society together. I am referring here to those cultural elements that generalize to large groups of the societal population and extend across numerous organizations. A parallel set of norms, roles, values, and goals pertains to the organizational component of institutional structure.

The Organizational Component of Institutional Structure

The second component of institutional structure is those organizations or agencies whose mission is the promulgation of the goals and values in given spheres of societal concern. These organizations share in the attributes of bureaucracy and in the elements and processes common to various kinds of complex organizations.* They have explicit responsibility for one or more of the areas of concern represented by given segments of the cultural component of institutional structure. For example, general societal norms about the obligation of citizens to preserve the cleanliness of our environment may require the creation of specific public agencies charged with enforcing that obligation.

Organizations constitute the most focused and purposive form of general societal organization of collective effort. They are characterized by purposes which give meaning and direction to the organization's existence and activities; boundaries which delineate the organization's personnel, responsibilities, and resources; explicit formal structure which divides, allocates, and patterns the organization's labor, power, and authority, and arranges its communication; technologies which transform raw materials into finished product and which maintain the organizational system; and an identifiable "team" of people who work on assignments presumed to further the organization's purposes.

The Interorganizational Component of Institutional Structure

The third component of institutional structure is the relations and interactions among sets of organizations (Warner, 1971:107-109). For example, water resources problems invariably extend beyond the jurisdiction of any of the numerous local, state, national, and international organizations concerned with water resources as well as across the private and public sectors of society. *Consequently, the outcome for water resources management is a function of the relations and interactions of those numerous and diverse organizations, as well as a function of the sum of what each organization does.* To the extent that the activities of the organizations in a given problem area are coordinated, the probability that the outcome will be the desired one is increased.

The most common kind of formal structure linking organizations is some kind of coordinating mechanism. Coordinating agencies or committees are set up to assume responsibility for getting various organizations to cooperate in an issue area. That many of these attempts accomplish little suggests that little useful interorganizational structure has in fact been created. It also indicates that these attempts to develop cooperative interorganizational structure have not dealt adequately with the realities such as organizational preoccupation with survival and of interorganizational rivalries.

Relations among organizations may have informal as well as formal structure. Informal interorganizational structure may be described by means of "organizational sets." There are various kinds of sets, but only two will be mentioned here. One set contains organizations of a similar kind that are visible to each other, communicate with each other, have a prestige order, have some personnel interchangeability, and have some important activities in common. Some degree of ordering what organizations do and how they relate to others results from participation in such "sets" (Warner, 1971:107; Caplow, 1964:Ch.6). A second kind of set is similar to the "task environment" of an organization. This kind of set contains organizations of different kinds. A given organization relates to other organizations that supply its resources, use its products and services, compete for its resources or for its market for products and services, or that exert some regulatory influence on it (Warner, 1971: 108; Thompson, 1967:27-29). Some degree of ordering or structuring among organizations also results from the existence and operation of these kinds of "sets."

Thus, as in the case of both the cultural and organizational components of institutional structure, there are both formal and informal kinds of structure in interorganizational relations. Both kinds must be understood if the nature and consequences of institutional structure is to be understood.

Institutional Structure as a Composite

The concept of institutional structure that I am suggesting is a composite of these three components: cultural, organizational, and interorganizational. Together these components represent the nature of the social structure in the various institutional areas of society. For a given area of societal concern, such as water resources, there are cultural norms, laws, and roles which connect the preservation, development, and use of water resources to the orientations and actions of members of society, which govern the water resource organizations and agencies, and which govern interorganizational relations.

Moreover, each of these components of institutional structure -- the cultural, organizational, and interorganizational -- has the general characteristics mentioned earlier: relative importance in society; social

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* I speak of organizations, although some groups are also involved, e.g., families; these do not, of course, have the attributes of bureaucracy and complex organization.

acceptance, establishment, and legitimacy; and value infusion. Therefore, the three components and the three kinds of characteristics describe one approach to the phenomena of institutional structure to be studied and applied to problems of water resources management. To put the idea another way, some broad features of the institutional structure of water resources management are outlined by the three components and the three characteristics described below.

Whether one's purpose is to understand institutional structure or to change it, he will need to recognize that a composite of these three components is involved. Each is part of the whole, and interaction between the sectors must be taken into account. Attempts to make significant and comprehensive changes in the institutional structure by law or by administrative edict alone, risk the consequence of "social fate": the actual outcome may not correspond very closely with that which was desired.

Institutional Components and the Theory of Organization

In the study of the components of institutional structure I have suggested that the areas to be analyzed are norms and roles (the cultural component); organizational power and control, goals, and technology, (the organizational component); and links and cooperative relations between organizations (the interorganizational component). But study of these components needs some focus. What should be its focus? The attributes of organization outlined in an earlier section are prime candidates: identifiability, power, foresight, and accountability.

These attributes, along with the three components of institutional structure, provide a *framework* for study of institutional effectiveness and accountability in water resources management. (See Figure 1, p. .) The columns in Figure 1 stand for the attributes as they apply to each component, and the rows represent the attributes as they apply to the composite picture of institutional structure which is the sum of the three components. Thorough analysis of the phenomena outlined by this framework as they apply to water resources management would represent a major contribution toward building reliable knowledge about the organizational aspects of such management.

Attributes of the cultural component. Column A - D represents some of the key issues in understanding the cultural component: Who are the people who can influence the nature and outcome of the norms, roles, values, and goals? Where is the power to influence outcomes, and what is its nature? To what extent is foresight possible regarding the consequences of decisions and actions in the cultural sphere? Who can be held accountable for the outcomes?

The family and the schools are normally identified as the major means for the formation and transmission of cultural content. But there are so many schools, and especially so many families, that it is difficult to locate sources of significant influence on the total outcome for an area or for the total society. Another deterrent to the easy location of sources of influence is the increasingly important role played by the mass media in public affairs programming, advertising, entertainment, and news coverage. Social movements such as the current environmental movement may also make changes in the cultural component of institutional structures including that of water resources management, although the exact nature and extent of those changes may be hard to determine.

Social movement leaders and other opinion leaders are among the influential persons in this cultural sphere; however, it is difficult to identify the relatively small number of persons who (a) have the power to influence water resources outcomes, and (b) can accurately foresee the consequences of actions in this sphere. Therefore, since we cannot hold any specific people very strictly accountable, there is a rela tively low degree of effective organization in this sphere. But the degree of effective organization is both variable and subject to some amount of purposive control by society. Identification of significantly powerful people would probably be easier during the height of a movement such as the environmental movement than it would be early in the history of the movement.

The four attributes of institutional structure are important in the problem of purposive control of social structure; the cultural sphere is important in this regard but considerably less amenable to control (especially in a free society) than the organizational component. Cultural changes are slow; sometimes it takes years to identify and interpret their consequences. Nevertheless, the cultural component supplies a pattern to social actions, even though purposive control of this pattern is small, changes are slow, and consequences are difficult to see. The pattern can be observed, for example, when an institutional agency undertakes a program or project which runs counter to established, legitimized norms, values, goals, and roles of the citizenry of an area. Public apathy or histility can result in ill effects for the organizational program or project, and this apathy or hostility is likely to have roots in the cultural patterns.

Attributes of the organizational component. Column E - H of Figure 1 outlines the four attributes of the organizational component of institutional structure. Of the three components, the organizational represents the greatest immediate potential for effective structure, since organizations have identifiable persons, power to influence outcomes, and desire to foresee and plan alternatives. Consequently, it is possible to assign some accountability for organizational outcomes.

Institutional organizations may vary considerably in the degree to which they possess these four attributes. Although organizations approximate effective structure more closely than do the cultural and interorganizational components, they also have chronic problems in making their actual structure, processes, and outcomes correspond with what is claimed on paper. Organizations tend to have serious deficiencies in their identification of and agreement upon desired outcomes, in their development of organizational technology, in their ability to foresee the consequences of their actions, and in the degree to which they may be held accountable.

Organizations tend *not* to specify or measure nonmaterial outcomes very systematically or accurately; *not* to allocate a very great proportion of their organizational resources to development of an effective structure and technology; and *not* to render an accounting of the use of resources, the production of outcomes, or the identity of the persons who benefit from the organization's efforts. Instead, organizations tend to take their purposes, structure, and technology as givens (not as matters for serious and sustained research and development), to undergo goal

FIGURE 1. ATTRIBUTES OF INSTITUTIONAL STRUCTURE

Attributes of Organization	Components of Institutional Structure: Cultural	Organizational	Interorganizational
Identifiability of persons	(A)	(E)	(I)
	For each component: Who are people having power to influence significantly the outcomes, having or needing foresight regarding the consequences of their actions, and rendering accountability for decisions, actions, and outcomes?		
	(1)	(2)	(3)
Power to influence outcomes	(B)	(F)	(J)
	For each component: How much power is available to influence outcomes, what is its nature, how is it structured, and how is it used?		
	(4)	(5)	(6)
Foresight regarding consequences	(C)	(G)	(K)
	For each component: What foresight is developed, how much of it is used, how is the use implemented, and what essential foresight is lacking?		
	(7)	(8)	(9)
Accountability for decisions, actions, and outcomes	(D)	(H)	(L)
	For each component: How much accountability is effected, how is it accomplished, and what essential accountability is left unattained?		
	(10)	(11)	(12)

displacement wherein their major claimed objectives (especially the nonmaterial ones) are subordinated to a preoccupation with organizational survival and growth, and to try to solve their problems exclusively through material technology and greater resources for organizational use (Warner and Havens, 1968).

Attributes of the interorganizational component. Column I - L represents the four attributes of the interorganizational component of institutional structure. Like the cultural dimension, the interorganizational dimension is not very amenable to purposive control. Who is responsible for problems that transcend the boundaries and jurisdictions of particular organizations? Who has power to influence the outcomes? Who can foresee the consequences of the individual and joint actions of numerous and diverse organizations, some of which are cooperating, some competing, and some simply ignoring each other? And who may be held accountable for the outcome? These are the key questions which if answered would add substantial information about a given area of concern, such as water resources management.

Some of the outcomes of resources management in this country (perhaps a considerable number of them) may be the unintended result of the innumerable intentions of numerous organizations, each pursuing mainly its own interests (and those of its constituency). There do not appear to be adequate mechanisms for assessing the public's interest, identifying the desired outcomes, specifying the intended beneficiaries, dividing the necessary labor, and then coordinating the activities to make the actual outcome correspond reasonably closely to that which is desired. In other words, despite numerous pleas for coordination and cooperation, and numerous regulations and mechanisms presumably requiring some interorganizational realm appears to be low.

Attributes of the institutional composite. The rows of Figure 1 outline key attributes of the composite institutional structure. Row 1 - 3 represents the identifiability attribute. The issue here is what leaders can be identified for each component so that a combination of leaders might adequately represent the cultural, organizational, and interorganizational aspects of the "management" of water resources.

Row 4 - 6 represents the issue of what power is available for controlling efforts and outcomes for the total of the three components. Is the power for influencing the cultural component located in the same people as the power for the organizational or interorganizational components? What are the interaction patterns among those persons and their modes of power?

Row 7 - 9 represents the foresight problem. Who can foresee the consequences of decisions and actions in each sphere? Are they the same people in each case? Who has responsibility for developing foresight along these lines when it does not exist? How adequate is the total of the foresight in the three components taken together? How do developments in one sphere affect our ability to predict results in another?

Row 10 - 12 reflects the accountability issue. To what extent is it possible to hold any relatively small group of people accountable for the joint outcome of the three components? How much overlap exists in the group of persons most accountable for each component? What could be done to increase the total accountability of identifiable persons for the composite of the three spheres of institutional structure?

The foregoing discussion suggests that Figure 1 represents a "conceptual map" of the needed research on institutional structure. While we continue to obtain and refine detailed information about the physical science and technology of water resources management, we still need elementary information about the organizational issues of management which have been outlined in the preceding discussion.

An Accountability "Theory" of Institutional Effectiveness

The concept of organization or structure discussed at the beginning of this essay included by definition some idea of effectiveness. In general, effectiveness was characterized as the degree of correspondence between actual outcome and desired outcome of the organized, collective efforts of people. The following discussion will provide some elaboration of that concept.

Although this concept of effectiveness is applicable to the cultural and interorganizational components insofar as there is purposive effort and control involved in them, it applies most obviously to the organizational component; I shall accordingly limit my discussion to that component. If the analysis were to be widened, the interorganizational structure would be the next clearest case since it has the second greatest degree of structure and amenability to control, although law, as one portion of the cultural component, is also relatively amenable to application of these ideas.

The purpose of this section is to fill in a part of the outline discussed in the preceding section by suggesting some hypotheses about the effectiveness of institutional organizations and the role played by measurement, information, and accountability in effective action. I selected the variables on the presumption that dealing with outcomes has a strategic priority over dealing with presumed causes or means at this stage of knowledge about effectiveness problems. Accordingly, I focus on outcomes and some of the elements that seem promising as determinants of them.

Effectiveness. Three important questions* in institutional effectiveness are:

1. How adequate and appropriate are the goals or intended outcomes?

2. How adequately are the goals attained?

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* There are other, more complete ways of putting the effectiveness issue. For example, Georgopoulos and Tannenbaum include productivity, flexibility (adjustment to internal and external change), and absence of intraorganizational strain (535-536).

We could focus more specifically on the adequacy of the organizational structure, policies, and programs, but, in general, effectiveness is concerned with something like productivity or benefits, or outcome, and with the means for obtaining such outcome *over time* (i.e., obtaining it now, and on a continuing basis). This paper focuses on issues of outcome on the premise that the relevance of discussions about means is to an important degree premature until the outcome can be identified and to some extent measured. See also Warner, 1967a.

3. Who pays the costs, and who reaps the benefits of any such attainment?

(1) *The adequacy of the goals.* The first of these questions is rarely considered in the study of effectiveness. Studies of goal attainment tend to take the goals as given. Students of organization theory have been aware for some time that organizational goals cannot be taken at face value; the actual, operative goals are very often different from the formally claimed objectives. However, my point is not whether the organization is pursuing the goals it claims, but whether the goal selected is appropriate. That is, given the overall mission of the organization, or given the large societal problems in its sphere, will the attainment of the selected goal result in satisfaction of the general purpose, or fulfillment of the organizational mission, or solution of the societal problems?

Since institutional agencies typically do not deal systematically with this type of information, and since it appears to be a necessary (though not sufficient) condition for effectiveness, I suggest the following hypothesis:

> Hypothesis 1: *Effectiveness of institutional organizations will vary directly with the degree to which the organizations measure and monitor the correspondence between their avowed goals and their overall purpose or mission.*

(2) *The degree of goal attainment.* The second general question is more familiar: How adequately are the goals attained? There are a great many difficulties involved in answering this question.* For example, frequently major goals are not stated in a form that can give much specific guidance to organizational action or that lends itself to the measurement of attainment; organizations frequently espouse multiple and conflicting or competing goals; the attainment of certain major goals (the intangible ones) is typically not well measured; and there may be significant resistance within organizations to the measurement and assessment of goal attainment.

Nevertheless, information on these issues is essential to institutional effectiveness; therefore I suggest the following hypothesis:

> Hypothesis 2: *Effectiveness of institutional organizations will vary directly with the degree to which the organizations measure and monitor the attainment of all their major avowed goals (or the correspondence between desired outcomes and actual outcomes).*

(3) *Who pays and who benefits?* The third question is one of "distributive justice." It also is neglected in assessing the effectiveness of institutional agencies. Goal attainment is always a question of attainment for whom, and any expenditure of resources means that the costs will be borne by someone. Hence, the more general question of institutional effectiveness is always the question of effective for whom and at whose expense.

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* Some of the problems of measuring goal attainment are discussed in Warner, 1967b. Although that discussion focuses on problems in measuring goal attainment in voluntary organizations, most of the points are applicable to the various intangible goals of institutional organizations.

Since the "desired outcome" of institutional programs requires knowing the identity of both those who desire it (the claimed intended beneficiaries) and those who must pay the costs, such information will also be related to the question of the program's effectiveness. Therefore, I suggest the following hypothesis:

> Hypothesis 3: *Effectiveness of institutional organizations will vary directly with the degree to which the organizations measure and monitor who actually benefits from, and who actually pays the costs of, the institutional operations and programs.*

Each of the three hypotheses suggested above requires the development of systematic information about key aspects of institutional effectiveness. *The more general proposition from which each hypothesis flows is that systematic, periodic information about the elements of effectiveness is essential (though not sufficient) for a relatively high degree of, and substantial improvement of, effectiveness.* And it is this proposition that provides the foundation for hypotheses about what I suggest is a major factor in, and leverage point for improvement of, effectiveness -- namely, accountability.

Accountability

Two main elements are involved in accountability, as the term is used here: (1) responsibility for the use of resources and for outcome, and (2) responsibility for *developing and providing information* to appropriate people (such as the public) about the use of resources and the outcome. There are other dimensions, but these are most central to the purposes of this paper.

People who call for accountability from institutional leaders need understanding and prudence. The public needs to understand the technical possibilities and requirements of leadership and organization in order to judge whether a reasonable job is being done by the leaders of the institutional structure. But many people lack this understanding and are not able to respond adequately to the problem.

For example, it is common to urge responsibility for certain outcomes upon leaders or organizations whether or not they have been given sufficient power and resources to do what is required. It is also common to subject a particular agency to public scrutiny without regard for the competitive circumstances in which that agency must struggle for survival. Situations of comparative advantage or disadvantage can result when one institutional organization is held accountable but other similar or related agencies are not, or when the interorganizational and cultural components are ignored. Personnel salaries are still another common example of public scrutiny which results in inequitable assessment. The salaries of public officials are often publicized because those persons are presumably accountable to the general public, but these salaries are seldom compared with salaries of officials in private industry who have similar tasks and responsibilities. Consequently, the public may draw misleading conclusions about the use of resources.

An unbalanced and misleading picture may emerge from attempting to scrutinize and hold accountable one agency without a basis for comparison with others. So long as technical measurements for effectiveness are

unavailable, and so long as presumed cause/effect relations are uncertain, comparison with other organizations with similar goals, structures, and circumstances is the best available method of assessing effectiveness.

The conclusion to be drawn from these considerations is that accountability should be examined in the context of the entire set of leaders and organizations in the institutional framework of water resources management, including the cultural and interorganizational components as well as the organizational. In addition, accountability should be interpreted in the context of the technical requirements of organization and leadership and the social constraints within which they operate.

When it comes to applying the accountability concept to the exploration of institutional effectiveness, there are three main questions to consider: (1) who is accountable? (2) to whom are they accountable? (3) for what are they accountable?

Who is accountable? The structure of organizations places the major power, authority, and control at the top of the hierarchy. In fact hierarchies are usually defined in terms of levels of increasing power and authority. Coincident with the level of power and authority is an increasing scope of information (access to the organizational "secrets"). Hence, if accountability accompanies the power and authority to control outcomes and the information with which to foresee consequences, then it will tend to rest primarily with those persons occupying the top echelons of the organization -- the top management.*

Nevertheless, in many institutional agencies, especially public agencies, significant control lies in bodies outside the organization, such as legislatures or legislative committees, boards of directors, or other such groups. Insofar as they exercise control over the organizational outcomes, accountability also rests with them.

In spite of these facts, a common tactic of organizational administration is to assign responsibility for organizational outcomes to the lower echelons. This is done on the premise that the best solution to problems of effectiveness is simply for the organizational personnel to work harder at their jobs. But when adequate power and information necessary for really effecting the desired outcomes are not shifted down the organizational hierarchy along with that responsibility, effectiveness does not result.

Consider the following hypothesis:

> Hypothesis 4: *Effectiveness will vary with the extent to which accountability is fixed primarily upon the higher echelons of the organization (including sectors of superordinate control, such as boards and legislative committees) rather than upon the lower echelons, unless there is a very substantial delegation to the lower echelons of power and information.*

Accountable to whom? The constituencies to whom top institutional leaders are accountable vary depending upon the nature of the organization they serve (public or private) and identity of the organization's sponsors (supporters, owners, and the like); and the problems involved in the pursuit of the organization's mission. To be effective in attaining their claimed goals, public organizations should be accountable to the general public. But in fact they tend to be more accountable to their representatives and representative groups (legislatures, legislative committees), and to private interest groups. The sponsors of private business concerns are, of course, the owners. Whether they are public or private, organizations tend to be accountable primarily to those sponsors who ho control over the resources to be allocated.

When problems involved in the pursuit of the organizational goals involve the public interest, there tends to be a demand for even private firms to be accountable on some issues to the public or its representatives, such as regulatory agencies. In water resources, for example, the activities of pulp and paper mills, private electricity-generating plants, and other industrial firms utilizing substantial quantities of water tend to elicit demands for public accountability even though the firms are private.

Accountability only to representatives of the public or to private interest groups yields no high degree of effectiveness in the sense in which we employ it here. Responsibility to the general public would be a much more powerful lever, since the examination of the facts of a case by large numbers of people with varying interests and viewpoints is more likely to result in effectiveness. Hence, the following hypothesis:

> Hypothesis 5: *Effectiveness of institutional organizations will vary directly with the extent to which the public has access to information about the organizations' effectiveness.*

Accountable for what? The question of what leaders are to be held accountable for is answered in a general way by the three basic questions regarding institutional effectiveness that were listed above: are the goals adequate? is the goal attainment adequate? who pays and who benefits? Because information relevant to these questions tends not to be developed and publicized, administrative leadership in this area remains underdeveloped.

Organizations do develop and promulgate some information about these questions, but it is gathered selectively and presented in a way calculated to show the organization in the most favorable light. Information that relates to the public image of the organization is jealously guarded and carefully controlled in most institutional agencies, especially the kind of information that would constitute the basis for evaluation of the organization.

It is commonly supposed that the continued input of resources into an organization bears some relation to the effectiveness of the organization's operations. But a great many institutional agencies experience, wholly or partially, a separation of inputs from outputs;* in the organization as a whole or in some of its

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* This is not to say that lower echelons do not have any accountability. But the accountability that most efficiently determines the organizational outcomes rests at the top.

* Downs (1967:24-31) includes in his definition of "bureaus" the idea that little of the output of that kind of organization is evaluated in external markets. This attribute has a number of important consequences for the organization.

departments the input of monetary resources bears no strict relation to the worth of the output because there is no monetary assessment of the output, and often no fairly complete and systematic determination of outcomes even in non-monetary terms.

Since outcomes are frequently not specified in measurable terms (sometimes they are not even agreed upon) and the cause/effect relationships that would yield the desired outcomes tend to be little known; consequently organizations develop other methods of handling the assessment problem. Thompson (1967:Ch.7) discusses such conditions, stressing the propensity of organizations to seek assessment in terms of a demonstration of "fitness for future action" and some historical improvement in such fitness and to emphasize those criteria of assessment most closely connected with the task environment.

The point is that institutional agencies do not have to demonstrate effectiveness regarding claimed outcomes in order to continue to obtain an input of resources for maintaining the organization. So long as this is true, relatively little improvement in organizational effectiveness may be expected. Therefore, the following hypothesis holds regarding the question of "accountability for what":

> Hypothesis 6: *Effectiveness of institutional organizations will vary directly with the extent of accountability of the leaders for effectiveness, including the adequacy of the goals, the degree of goal attainment, and the question of distributive justice.*

Further hypotheses. Of the six preceding hypotheses, the last two, those dealing with public accessibility of information about effectiveness and with the nature of the information to be made accessible, are most crucial. Considerable potential for understanding differential degrees of institutional effectiveness rests on them. We would expect to find a substantially greater degree of effectiveness among institutional agencies which recognize and enforce the obligation of institutional leaders to develop the information necessary to determine whether organizational goals are adequate, whether the degree of attainment is adequate, and which segments of the public bear the costs and receive the benefits and to recognize and enforce the obligation to make this information easily and widely accessible. This suggests the following hypothesis, which is simply a combination of hypotheses 5 and 6:

> Hypothesis 7: *Effectiveness of institutional organizations will vary directly with the extent to which the public has access to information about the adequacy of the goals, degree of goal attainment, and the nature of distributive justice.*

The presumption is that public accessibility to such information will result in some eventual influence on the nature of the organization and its courses of action. Legislation may regulate the organization's domain or alter its structure; public opinion may influence administrative action. The most effective influence, and one subject to continuous or periodic control, is influence on the input of resources to the organization.

Institutional organizations are preoccupied with insuring the continuation and growth of resource inputs. Since they do not have a continuous or periodic reading from the marketplace about the worth of their products or services, they must make their case on other grounds. The activities and programs of the organization tend to be shaped by considerations of organizational survival and protection of position first, and of attainment of major organizational goals second. A chief means, therefore, of enforcing the principle of accountability is to make it relate to the continuation of input resources for the organization.* This suggests the following hypothesis:

> Hypothesis 8: *Effectiveness of institutional organizations will vary directly with the extent to which the input of resources to the organization is contingent upon accountability by the organizational leaders for the development of and public accessibility to adequate information about:*
>
> (1) *the correspondence between the avowed organizational goals and the overall purpose or mission of the organization,*
> (2) *the attainment of all major organizational goals,*
> (3) *who pays the costs of the institutional operations and programs, and*
> (4) *who benefits from the organizational outcomes.*

These eight hypotheses taken together outline an accountability "theory" for measuring the effectiveness of institutional organizations. The first six focus on the variables of effectiveness and accountability. The seventh simply combines the two preceding hypotheses. And the eight adds the idea of sanctions -- the contingency of input resources on the leaders' being accountable for effectiveness. Application is to institutional agencies. For a complete "theory" relating to the institutional framework outlined earlier in this paper, hypotheses would have to be developed for the cultural and interorganizational components in addition to the organizational component. Additionally, some account would have to be taken of how these three components might interact to produce joint effects not attributable to any single component.**

The "theory" sketched above has not developed much detail because the intent was not to offer a rigorous, formalized theory, but rather to offer a working outline for the guidance of some needed research. On the basis of such research, the prospects and potential of a more detailed and rigorous theory might be better assessed.

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* A major deterrent to enhancing institutional effectiveness lies in the ability of organizations to manipulate or manage impressions about their programs and outcomes independent of the actual outcomes in order to obtain inputs of resources. Resources obtained in this way can be devoted to further "selling" of the organization and hence can produce still more resources. To some extent this phenomenon is operative in the cultural and interorganizational spheres as well as the organization sphere. Accountability must take note of such information management and find ways to obtain more reliable and valid bases of assessment and methods of reporting to the public.

** Again it should be noted that this focuses on outcomes. A more complete theory would have to enlarge upon the idea of outcomes (e.g., there are other kinds of outcomes than goal attainment), and would have to include careful attention to organizational structure, processes, and environments as means and constraints relating to the organizational ends.

SUMMARY AND DISCUSSION

In this paper I have suggested a conceptual framework and a "theory" of institutional effectiveness and accountability that are *applicable* to water resources management, but not *unique* to it. The reason for this approach is the scarcity of theoretical and empirical work on institutional aspects of water resources management. In view of that, it makes sense to draw upon as much general institutional theory and research as possible in the focus on water resources issues. The framework and hypotheses offered in this paper have their roots in the wider context.

This paper also suggests a concept of effective organization, based on a discussion by Mills, organized around four key attributes: (1) identifiability, (2) power, (3) foresight, and (4) accountability.

It describes three general characteristics of institutional structure: (1) relative importance in society, (2) societal acceptance, establishment, and legitimacy, and (3) value infusion. These characteristics are the distinguishing features of institutional, as compared to noninstitutional, forms of social organization.

Three components of institutional structure are outlined here: (1) the cultural component; (2) the organizational component, and (3) the interorganizational component. I suggest that institutional structure is a composite of these three components, and that attempts to understand or to change the institutional structure need to take this into account. Laws or administrative decrees may fail to solve resource management problems unless such consideration goes into their design and implementation. The three components, along with the four key attributes of effective organization, form a framework or conceptual map for the analysis of institutional structure.

Finally, the paper presents an accountability "theory" of institutional effectiveness consisting of eight strategic hypotheses regarding the organizational component of institutional structure. A more complete theory of institutional structure would have to develop hypotheses for the cultural and interorganizational components as well. A key point in the "theory" sketched above is the *measurement and monitoring of institutional outcomes*. Just as baseline measurements and continuing surveillance or monitoring of values are essential for dealing with such problems as pollutants, temperatures, and water supply, so they are essential for dealing with institutional practices and consequences. The assessment of alternative institutional arrangements (structure, policies, and programs), for example, requires this kind of information.

Application of the foregoing outline to the institutional phenomena of water resources management would yield a great deal of significant information that appears to be unavailable at the present time.

There is an understandable impatience for answers, and not simply questions -- for research results and not simply statements of needed research -- in the social-organizational-institutional sector of water resources management. But answers in this field are no more cost-free than answers in the fields of physical science and engineering technology, and so far investments sufficient to produce answers have not been made. It is impossible to draw water from a reservoir that has not been filled.

Responsible administrative leadership, both in water resources management and in research and development in that field, will recognize the need to invest in the search for reliable knowledge about institutional factors of management. There is no other way to adequately respond to public water resource needs.

One priority item of needed research, then, is a sustained, cooperative effort by three groups of people: institutional leaders, research supporting agencies, and research scholars. Their task would be to develop and refine the kind of information outlined on the preceding pages. Without the cooperation of those three groups, it would be extremely difficult to develop the needed knowledge because no one group has access to all the resources necessary for the task. And without the kind of knowledge to be sought by this process, it would be difficult to demonstrate the extent to which institutional factors are important in water resources management.

REFERENCES CITED

Bierstedt, Robert.
1957 The Social Order: An Introduction to Sociology. New York: McGraw-Hill.

Broom, Leonard, and Philip Selznick.
1963 Sociology: A Text with Adapted Readings, 3rd edition. New York: Harper and Row.

Caplow, Theodore
1964 Principles of Organization. New York: Harcourt, Brace & World.

Clark, Burton R.
1956 "Organizational adaptation and precarious values: a case study." American Sociological Review 21 (June): 327-336.

Downs, Anthony.
1967 Inside Bureaucracy. Boston: Little, Brown.

Georgopoulos, Basil S., and Arnold S. Tannenbaum.
1957 "A study of organizational effectiveness." American Sociological Review 22 (October): 534-540.

Ghorpade, Jaisingh (ed.).
1971 Assessment of Organizational Effectiveness: Issues, Analysis, and Readings. Pacific Palisades, California: Goodyear Publishing Company.

Kaplan, Howard B.
1960 "The concept of institution: a review, evaluation, and suggested research procedure." Social Forces 39 (December): 176-180.

Mills, C. Wright.
1959 The Sociological Imagination. New York: Oxford University Press.

Selznick, Philip.
1957 Leadership in Administration: A Sociological Interpretation. Evanston, Illinois: Row, Peterson.

Thompson, James D.
1967 Organizations in Action: Social Science Bases of Administrative Theory. New York: McGraw-Hill.

Warner, W. Keith.
1967a "Feedback in administration." Journal of Cooperative Extension 5 (Spring): 35-46.
1967b "Problems in measuring the goal attainment of voluntary organizations." Adult Education 19 (Fall): 3-14.
1971 "Structural matrix of development." Ch. 4 (pp. 94-115) in George M. Beal, Ronald C. Powers, and E. Walter Coward, Jr. (eds.), Sociological Perspectives of Domestic Development. Ames: Iowa State University Press.

Warner, W. Keith and A. Eugene Havens.
1968 "Goal displacement and the intangibility of organizational goals." Administrative Science Quarterly 12 (March): 539-555.

Williams, Robin M., Jr.
1960 American Society: A Sociological Interpretation, 2nd. edition, revised. New York: Alfred A. Knopf.

Chapter Four
Institutions and Urban Water Management--A Public Administrative Perspective

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The purpose of this essay is to examine from the perspective of a student of public administration the concept of "institutions" as it relates to urban systems. The bias of the perspective is that it seeks knowledge about urban systems in order to enhance our ability to manage resources to achieve human values.

Words are necessary for communication, but they are ambiguous symbols, especially common words such as "institutions." It might be argued that social science, like medieval scholasticism, feeds on this ambiguity, since the incessant dialogue over meaning provides for endless exercises in the honing of concepts to fit a particular metaphysical bias. Lacking a neat physical unit which can be measured and tested under experimental conditions, what goes under the name of social science scholarship is in danger of eroding into time-consuming arguments over the meaning of concepts neither anchored in theory nor subject to testing through research.

One of the first scholars to attack the problem of defining institutions so as to expose them to empirical analysis was Floyd H. Allport, who had written in 1924 a landmark text, *Social Psychology*. Nine years later he published an equally impressive work, *Institutional Behavior*, in which, determined to rescue the study of multi-individual behavior from the murk of sociological jargon, he attacked the "institutional fallacy" and applied a behavioralistic approach to the definition of institutions, which was to treat institutions as collections not of individuals, but of a portion of the activities of individuals" (1933:ix) and institutional behavior as "that portion of human action which we can observe through studying individuals as they function in their institutional relationships" (1933:27). As Katz and Kahn have stated, Allport was insisting "that in any science the language of metaphor was not an adequate substitute for the language of data" (1966:8).

It is interesting to note that, with the exception of Katz and Kahn, contemporary works on organization theory make no reference to Allport's work. A recent article by a sociologist summarizing current concepts of institutions concludes that the concept of social institutions should be stripped of its metaphysical content and reformulated so that institutions could be dealt with in empirical terms (Martin, 1968:100-108). This, of course, is precisely what Allport had done thirty-five years earlier.

Allport's critique of earlier approaches to institutions gave way in his own work to the development of a theory of social structure based upon interrelated event cycles -- that is, systems of events.* The event-structure approach was more sophisticated than his earlier critiques and was compatible with the general systems theory which was emerging in the forties and fifties and becoming dominant in social theory in the sixties and seventies.

Although the memories of sociologists may be short or their perception spans narrow, political systems theorists appear not to consider the formulation of a concept of institutions necessary to their theory. In two standard works employing the systems approach to political science, Easton's *The Political System* (1953) and Deutsch's *The Nerves of Government* (1963), the concept of institutions does not appear to be applied as a necessary construct. Indeed, to political scientists, institutions imply structure, and for several decades now preoccupation with the structure of government has lost status as an approach to an understanding of political systems. When behaviorism finally permeated political science during the 1950's, the most conspicuous political behavior to be identified was voting by citizens, legislators, and judges. The consequence was an outpouring of literature which examined in the minutest detail the voting practices and habits of these three groups. It was eventually recognized that there was more to political behavior than the act of casting a vote; nevertheless structural considerations remained submerged as a more general systems approach emerged.

Public administration, which has always had an uneasy relationship with political science in particular and the social sciences in general, could never ignore the question of structure, since governmental operations are carried out through formal organizations consisting of legally prescribed roles and responsibilities. Herbert Simon and Chester I. Barnard led a successful attack against such overly mechanistic structural concepts associated with scientific management in the twenties and thirties as appear in Luther Gulick's *Papers on the Science of Administration* (1937). But even the students of administrative behavior had to admit to the existence of something called an "organization," although whether or not an organization was an institution or some special form of institution seems not to have concerned many of the modern students of organization theory. March and Simon's *Organizations*, which purports to summarize the state of knowledge concerning organizations as of the late fifties, discusses "the institutionalization of innovation" but does not discuss what an institution is or what relationship it bears to an organization, although there is a heading in Chapter One, "The Significance of Organizations as Social Institutions." This implies, of course, that organizations are taken for granted as types of social institutions but the latter are not defined (1958:8 and 184).

Katz and Kahn adopt Allport's approach to the definition of an institution and discuss formal organizations as though they were a form of social institutions. In a more formal sense they employ the Parsonian concept of an "institutional system" consisting of

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* See his Theories of Perception and the Concept of Structure, New York, John Wiley & Sons, 1955. See also "The structuring of events: outline of a general theory with application to psychology," Psychological Review (1961), 281-303.

the environment of organizations and agencies within which any given formal organization must function in order to maintain its own legitimacy and purpose (1966:97).

A third set of authors, Rubenstein and Haverstroh, state that "shared patterns of belief are referred to in social sciences as institutions" and go on to state that "much valuable knowledge about organizations consists of the specific institutional structures they have developed." They cite Weber's concept of bureaucracy as being concerned with institutional structure and illustrate by saying "the line of evolution in Western society traced by Weber and other sociologists was a transition from institutions based on tradition and centrally concerned with persons and their statuses over to rationalized institutions centrally concerned with an impersonal task" (1964:64). To define institutions in terms of shared beliefs rather than in terms of observable behavior seems to be a step back to pre-Allport attitudes, but the reference to Weber implies that the authors consider organizational structure and institutional structure synonymous.

The objective of this brief review of organization-theory literature is not to dissect the logic employed or to attempt to identify inconsistencies in the use of terms; rather it is to demonstrate that organization theory takes institutions for granted, without defining them. The first two sentences in March and Simon's work *Organizations* state:

> This book is about the theory of formal organizations. It is easier, and probably more useful, to give examples of formal organizations than to define the term (1958:1).

But when one tries to deal with formal organizations at a theoretical level, the need to define the term is clear.

Students of urban areas, whatever their background, had to face the fact of growing complexity in the patterning of behavior through something called organizations or institutions. Organizational complexity was growing at an apparently increasing rate as science and technology created new possibilities which in turn generated new demands. After all, political jurisdictions, corporations, civic associations, chambers of commerce and the like do have specific identities, and there is nothing ephemeral about their efforts to influence decisions and behaviors. In the early 1920's, C. E. Merriman at the University of Chicago directed and stimulated a number of studies documenting the Chicago region's pluralism in political jurisdiction which imposed dysfunctional conditions upon the providing of essential services. A proposed solution was that "regional Chicago might become the forty-ninth state" (Steadman, 1930:267). (Although the proposal was not taken seriously at the time, a similar proposal was made by Mayor Lindsay for New York in the late 1960's.)

If the Chicago studies were read, they certainly were not heeded. In fact, the study of urban problems, which unhappily got mixed in with the study of something called "local government" -- an unfortunate conglomeration of all political jurisdictions smaller than a state -- went out of style for almost three decades, yet urban problems were increasing. By the early 1950's urban areas had recovered from the depression of the thirties and the post-World War II boom was beginning to create new pressures as a result of population and economic growth.

An early work during the decade of the fifties, Floyd Hunter's study of Atlanta (1953) focused upon power relationships as perceived by influential members of the community. Institutional roles influenced the positioning of relationships, and the resulting model was of a hierarchy of power with top positions occupied by the owners of the major home-based business enterprises. Although the model might be appropriate for explaining behavior in the smaller "company towns," of which there were and probably still are many in America, students of larger and more complex metropolises were discovering that understanding the urban system required a more sophisticated theory. Indeed, in a paper that he delivered at a seminar in Operations Research at Johns Hopkins University in 1953, Barnard declared that urban systems as large and complex as that of New York had not developed through any rational planned design but had simply evolved incrementally. He felt that New York had reached such a stage of complexity in both formal and informal organizational structure that stability could be explained only by means of a concept such as the Unseen Hand. Barnard was not recommending reliance on the Unseen Hand, but he was suggesting that more had to be known about the nature of organizations and inter-organizational relationships before a large agglomeration such as an urban system could be "managed."

By the end of the decade of the fifties, studies of larger urban systems began to appear. Focusing upon a single policy area, public housing and urban redevelopment, Meyerson and Banfield examined decision-making in Chicago and described how the economic and political systems responded to the demand for housing among the poor and lower-middle class. In their study they also showed how housing policies of the fifties resulted in intensification of racial segregation (1955). Wright and I studied ten cases in Detroit which dealt with issues ranging from urban redevelopment of black neighborhoods in the central city to annexation and consolidation controversies in suburban areas (1962). The most ambitious study of a single metropolitan region was that which the Graduate School of Public Administration at Harvard University conducted for the Regional Plan Association covering the New York Metropolitan region. The study produced nine volumes and devoted a good deal of attention to economic variables. Robert C. Wood conducted the study of the political economy, and the title of his book, *1400 Governments*, (1961) is indicative of his findings concerning the governmental structure within the region. By the mid-1960's, urban studies were in style again, partly because urban problems were made visible by the poverty program and, during the latter part of the sixties, by the urban riots.

The concept of institutions is either implicitly or explicitly part of the conceptual framework employed by those studying urban systems. In my Detroit study, I specified five variables which determine the limits and potentialities of an urban system: physical environment, human biology, available science and technology, institutions (social, economic, and political), and values. The institutional variable was explained as follows:

> Integral to the metropolis is its elaborate institutional structure, composed of everything from the loosely organized and ephemeral neighborhood civic associations to the highly formal and stable industrial corporations, labor unions, and governmental units. Because of the plural interests present in the metropolis, the organi-

zational environment is pluralistic, and the mapping of the institutional structures is a major feat in itself. The governmental jurisdictions are varied -- counties, cities, townships, villages, and school districts -- each with a definite boundary limiting the geographic extent of its powers. The major organizations in the metropolis have a formal organizational structure with positions manned by full-time employees employed to carry out the task of the organization. In other words, the bureaucratic type of organization prevails and relationships among organizations tend to be relationships among bureaucracies. The institutional structure is a framework which limits and channels behavior within the metropolitan system (Mowitz and Wright, 1962:4).

At the time I wrote this, it seemed to be an adequate explanation of the concept of institutions as employed in the study. If pressed, I would have argued that what was meant was Allport's notion that institutions consisted of segments of the behavior of individuals acting in relationship to each other in particular situations with a degree of regularity and predictability which distinguished them from random occurrences. It may be that students of organization and political theory and students of urban systems have been too casual in the treatment of institutions; therefore it would be useful now to restate the concept in more explicit terms. Such a statement might help to describe and to explain existing systems and at the same time to provide a basis for the design and implementation of institutions which will satisfy human values more effectively. For most certainly if urban water management is to take place, there must be an institutional structure within which the management can occur.

Underpinning a theory of institutions is the simple proposition that man abhors uncertainty, and, as the cyberneticists have pointed out, open systems employ information to counter the entropic drift toward randomness. Events that occur as anticipated reinforce a sense of certainty, and belief systems fill in the interstices of ignorance (that is, they provide explanations for events whose causes cannot be otherwise explained or whose effects cannot be controlled) with explanatory myths, including religious beliefs. The curse of the absolute unbeliever is absolute uncertainty.

If we accept Allport's definition of an institution as a collection of portions of activities of individuals, we can then define the institutionalization process as the prescription or proscription of interactive behavior according to whether it satisfies, in the first instance, biological values of survival and, in the second, in more advanced societies with more information available, plural sets of individual and societal values. The institutionalization process, therefore, reduces uncertainty in group behavioral situations. Formal organizations emerge in a behavioral sense when desired behavior occurs with a high degree of certainty and the behavioral expectations are fed back into a training and initiation process. As Weber points out, the patterning of behavioral requirements became more extensive with the emergence of an industrial society. As behavioral requirements became more sophisticated they began to be defined in terms of positions with specific duties and responsibilities and reinforced with rewards in the form of salary and status. The behavioral requirements thus established, in turn, educational requirements to be met by those attempting to enter the various roles or positions.

Organizational design first occurred in some distant past when some individual or group sat down and self-consciously identified the behavioral requirements necessary to accomplish some collective objective. Their product was the design for a formal organization. Their success in establishing the formal organization depended upon whether or not they had the resources necessary to accomplish their objectives, including both information about the probable effects of the required behavior and incentives, both positive and negative, to evoke the required behavior. Design was essential if the institutionalizing process were to be exploited as a means to accomplish specific collective goals through organizations instead of merely being accepted as the Unseen Hand at work. To the extent that some degree of certainty in human interaction is necessary for biological survival, the institutionalization process can be observed in any human group. The difference between the process of institutionalization and the use of the process as an organizational means is the element of design -- a self-conscious determination that certain programmed behavioral activities and relationships, i.e., organizations, are required in order to accomplish a given set of goals or satisfy a given set of needs.

For the private and voluntary sectors the design problem was simplified by the invention of the limited-liability corporation. That this newly created corporate entity was treated as if it were a person is testimony to a psychological commitment to the individual. Accepting the corporation -- an aggregation of segments of the behavior of many individuals -- as an entity for decision-making, production, and responsibility, encouraged the proliferation of organizations in the private and voluntary sectors, and for those with the time and resources it made possible membership and participation in more than one organization.* The limited-liability corporation established a legally recognized boundary for the private organization as a unit of policy-making and management. The corporation, as a macro unit, could serve over time as a fairly certain aggregation of individual behaviors which at the micro levels were fraught with uncertainties such as mortality. While the legal boundary gave the corporation identity, it did not necessarily limit corporate geographic scope, product mix, or size. Although Congress and the courts have struggled with antimonopoly legislation and standards as to the proper size and scope of corporate entities, no clear-cut criteria have emerged.

Uninhibited by boundary constraints, corporations have thus been able to adapt to changes in science and technology and to survive by being responsive to newly created needs and demands. Corporations are now among the largest organizational units in the world. Ranked according to number of employees the ten largest organizational units in the world in 1968 were:

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* In the United States, it took governmental officers much longer to acquire the benefits of limited liability. Throughout the nineteenth century the protection of public officers from suits for damages resulting from their acts was tenuous and the scope of governmental activity was decidedly limited. When, in the 1930's, the demands stemming from industrialization, urban growth, and economic uncertainty required more extensive governmental services and intervention, organizational forms evolved or were improvised, with the result that not only the liability but the responsibility of the public officer became submerged in a sea of structural and procedural complexity.

USSR
US Federal Government
Japan
General Motors
American Telephone and Telegraph
United Kingdom
Roman Catholic Church
Ford Motor Company
General Electric
National Coal Board of Britain

Ranked according to receipts or revenues for 1968 the following organizations were the first ten:

US Federal Government
USSR
West Germany
United Kingdom
France
General Motors
California
American Telephone and Telegraph
Standard Oil of New Jersey
Ford Motor Company

The rankings demonstrate that the constraints placed upon corporate design have not prevented enormous growth: corporations may operate at a magnitude greater than that of most national governments. (Among the twenty-five largest organizations ranked by number of employees, eighteen are business firms and seven are governments; and among the twenty-five largest organizations ranked by receipts and revenues, thirteen are business firms and twelve are governments.)

At this point it is necessary to recapitulate what has been said in order to focus on the problem of urban water management as it relates to institutions in the urban system. We have viewed the institutionalization process as the means by which behavioral requirements are established and maintained in order to satisfy the need for certainty, the need for survival, and other needs. Designed formal organizations are an attempt to determine self-consciously the behavior required to accomplish specific objectives which will satisfy the needs or wishes of the constituency to whom the designers are responsible. Design thus requires inferences concerning the links between behavior and its probable outcomes. When the causal links are known (at acceptable levels of certainty) prescribed behavior may be used to assure objective achievement; if the links are unknown, prescribed behavior is an hypothesis to be tested through experience. The design of formal organizations, therefore, is the self-conscious manipulation of the institutionalization process as a means to accomplish some end.

The design of urban water management requires an understanding of the institutional characteristics of urban systems to identify the limits and potentialities of the institutional means available. Two design variables are critical. One is information -- that is, how much is known about the relationship between behavior and desired outcomes? Science and technology provide extensive information about the sources, means of delivery, and quality requirements for different uses of water. In comparison with, for example, "welfare service" as a delivered governmental product requiring organizational design, water service is simplicity itself in terms of available knowledge and techniques for producing and delivering the product. The other significant variable affecting design potential is boundary conditions. All systems have boundaries that distinguish them from other systems. Topography and weather determine the natural boundaries of a watershed drainage system, whereas formal rules, laws, and contracts identify and protect boundaries of social and economic institutions. The very essence of a political jursidiction is its turf.

The concept of geographical boundaries is critical in political systems. Historically, establishing responsibility over land, usually by warfare, reduced uncertainty over who was responsible for what. Sovereignty within a set of boundaries was attained by institutionalizing the conditions obtaining at the end of the conflict. Government, of course, was an early form of formal organization. The creation of territorial political subsystems within larger national systems made sense when communication and travel were both slow and laborious. The American federal system, consisting of states with their own local government subsystems, was a quite elegant design, given the political and social values and technology of the eighteenth and most of the nineteenth centuries. But while private corporations had to struggle to survive (many perished as the Industrial Revolution progressed and science and technology became dominant variables in public demand for goods and services), in many states governmental subsystems had built-in protection which made it virtually impossible to change a given jurisdiction's boundaries. Corporations were required to change their product mix, adapt to changing demands, and made other appropriate adjustments in order to avoid going bankrupt or being swallowed by a larger firm. But the insulation of the boundary of the local political subsystem from such stress had consequences which now confront any management effort in an urban system.

We can now restate the problem as follows: "How can an urban water management system be designed that will at once satisfy human biological needs for water and waste disposal and human economic, social and cultural needs, given the nature of the institutional constraints caused by the aggregate of organizations functioning in an urban system?" The substantive focus, water supply, is critical, since water is an indispensable resource requirement for any society. Moreover, the formal organizations designed to satisfy water requirements range from private corporations to departments of local government and include almost every conceivable permutation of multijurisdictional single-functional *ad hoc* organizational improvisation. For example, in February, 1972, Bucks County, Pennsylvania, which lies between the city of Philadelphia and the State of New Jersey, with the Delaware River as its southern and eastern boundaries, had thirty-six different water utilities and forty-eight licensed sewer utilities. Among the water utilities were private water companies, municipal water systems, and water authorities covering more than a single jurisdiction. Twenty-two of the sewer utilities were municipal; the remaining twenty-six were either authorities covering more than one jurisdiction or systems maintained by private developers (such as shopping centers). In addition, there were about a dozen other miscellaneous organizational units in the county dealing with some aspect of water such as ports, flood control, or mosquito control. With a 1970 population of 415,000, Bucks County is an integral part of the Philadelphia metropolitan system. The county traces its origin to 1689, and its historical commitment to values of local self-government are deep-rooted.

In contrast to the water systems of the Philadelphia metropolis, the Detroit water system has become a regional water supply system servicing seventy communities in the metropolitan area (Wengert, 1968).

The difference in the institutional structure for water supply between metropolitan Detroit and metropolitan Philadelphia permits us to raise a number of questions concerning the current state of the art of organizational design as it relates to urban water management.

The first question: Is design possible in view of the working of the Unseen Hand, which at any one point produces a configuration which has both evolved and is in the process of evolving? This, of course, was the position taken by Barnard in the early fifties and is not inconsistent with the conclusions of Wood in his *1400 Governments*. By the mid-sixties the poverty program and federal aid to education, which gave special priority and resources to programs for the disadvantaged, suggest confidence in the feasibility of designing and managing programs for urban systems. By the end of the decade, however, there was loss of confidence in the capacity of these programs to perform as expected; such large-scale efforts were either abandoned entirely or redesigned. The new design assigned management to smaller enclaves in the name of "community control" or "decentralization"; the resulting interplay of political market forces, it was hoped, would establish an equilibrium, confining conflict to manageable levels and reducing the threats to larger-system values. Much of the literature dealing with school decentralization assumes that bargaining enclaves provide the best opportunity to develop a political marketplace for exchanges which will satisfy political and social values at some tolerable equilibrium level.*

A second question: Must not all design efforts be confined to what is possible within the social and economic environmental context of any given system? This position assumes a type of social-economic environmental determinism which constrains both the rate and the direction of institutional change. During the sixties studies employing aggregate data and comparing what were called "policy outcomes" (which were usually expenditure decisions of state and local government) concluded that social and economic characteristics of the jurisdictions analyzed were the most important policy determinants (Hofferbert, 1966:73-82 and Dye, 1967:353-380).** As Clarke has pointed out (1969: 1172-1182), the conclusions of the environmental determinists were probably an artifact of their research methods. In any event, since the social-economic characteristics of Bucks County and its various subsystems (boroughs and townships), which have not become part of a regional water system, are similar to those of Detroit and its suburban counties and local jurisdictions, which have, social-economic variables do not explain why the two systems have developed differently.

If, on the one hand, reliance on the working of the Unseen Hand is rejected, and, on the other, we cannot rely upon the "public-regardingness" of the reform-oriented, affluent, educated middle class to produce change,* how can one explain change in urban institutions? Without an explanation of change, design would not be possible. The answer may be less elusive than it appears.

In 1957, Pennsylvania changed its laws, giving its forty-three third-class cities the option of adopting new charters to replace the commission form with a mayor-council or council-manager plan. Ten years later, nine cities had voted to adopt new charters, twelve had attempted but failed to adopt new charters, and twenty-two cities had made no move toward charter change. The situation provided an opportunity for quasi-experiment, since time and legal constraints were the same for all of the cities, while their socio-economic and political characteristics varied considerably (the cities ranged from northeastern urban complexes such as Bethlehem and Allentown to Great Lakes cities such as Erie). Clarke tested the hypotheses which associated civic reform with social and economic environmental conditions and found that these variables did not explain adequately why some cities chose to change their charters, rejected a proposed change, or made no effort to change (1968). Although he could not explain the differences between the cities with aggregate socio-economic data, Clarke was able, by examining a given city, to identify political variables that would explain the decision in that particular case. These findings tended to confirm the conclusions of those who had used a case method to examine a single city by focusing upon crucial decisions affecting the urban systems as a whole. In short, the impetus for change sprang from individuals or groups who were convinced that the existing system was not performing adequately and who were therefore willing to engage in the necessary political activity, such as bargaining, persuasion, and argument, to challenge the values protecting existing boundaries in order to invoke a new set of values which would support a boundary change. The development of the Detroit regional water system fits these conditions. It did not evolve "naturally" as a result of the Unseen Hand, nor was it a result of the peculiar socio-economic environment of the Detroit metropolis, but was a direct result of political action taken initially by the bureaucracy of the Detroit Water Board and supported and reinforced by the larger political system.**

It is now possible to suggest some conditions for design which derive from the nature of institutional change and which bear on the future design of institutions for the management of urban water systems. An existing institutional configuration, although it may be explained by the working of the Unseen Hand over a period of time, does not have to be accepted as an inevitable product of immutable laws which dictate that all future change must take place at the same rate and direction as past change. Nor do the socio-economic characteristics of a given system *per se* either generate or prevent institutional change. Redesign of the institutional framework for managing a given urban water system will require a shift in the

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* See M. Gittell, Demonstration for Social Change, New York: Institute for Community Studies, Queens College of CUNY, 1971. This evaluation of decentralization in the New York school system, while documenting the conflicts that develop when enclaves are established, concludes that "local control may indeed be the instrument for change."

** For a critical review of this approach, see J. W. Clarke, "Environment, process and policy: a reconsideration," Political Science Review 63, (1969), 1172-1182.

* See E. C. Banfield and J. Q. Wilson, City Politics, Cambridge: Harvard University Press and Massachusetts Institute of Technology Press, 1963; the authors support the public-regardingness hypothesis.

** See "Water for southwestern Wayne County: an exercise in city-county competition," in Profiles of a Metropolis, 169-235, and N. Wengert and G. M. Walker, Jr., "Institutional constraints on the development of a regional water supply system: the case of Detroit." Proceedings, Fourth American Water Resources Conference, 1968.

boundary values supporting the existing configuration.

A critical test of boundary values faces every organization when it has to decide either to *make* something within its own boundaries or to *buy*, that is, obtain a given good or service from outside the organization's boundaries. Two general sets of values are involved in the "make or buy" decision, whether the organization is public or private. One class of values is concerned with efficiency and involves a cost analysis to determine whether it would cost less to make within the organization or buy from outside. (The term "cost" is used in its broadest sense to include such elements as opportunity costs, the technical and managerial capability of the vendor, and so on. The economics of source selection is seldom a problem of simple arithmetic.)

The other class of values is boundary values, which are determined by answering the question: Do efficiency values warrant giving up the decision-making discretion associated with retaining the entire operation within the boundaries of the organization? Even for private corporations there are conditions when "making" is preferable to "buying" even though the "buy" decision would involve the least cost in terms of efficiency values. In the case of the political jurisdiction, a make or buy decision requires an assessment of the political decision-making discretion that might be lost through relying on a vendor.

The Detroit Water Board became a regional water supplier because the jurisdictions that joined the system had decided that water supply decisions could be made in terms of efficiency values and that the Detroit water system could produce and deliver water to them at a better price than they could do it for themselves. What happened was that the Detroit Water Board succeeded in divesting itself of those boundary values which linked it to the political decision-making, and therefore the territorial limits, of the City of Detroit. Sufficient legal authority existed for the extraterritorial expansion without statutory or charter changes which would have required closer attention being given to the change in boundary values *per se*. But the territorial expansion of the water agency's boundaries could not have occurred without the reciprocal perception on the part of other jurisdictions that they were now dealing on business terms, i.e., haggling over price, quantity, and quality, with a vendor whose policy commitment was to efficiency values related to water rather than to the political values of the City of Detroit. The Detroit water agency thus became a limited-liability corporation. It had limited its political liability to Detroit and for all practical purposes was simply a public corporation. By purchasing rather than producing, the contracting jurisdictions did not, however, give up all internal decision-making concerning water. Since distribution systems were the responsibility of each jurisdiction, local political values could be considered in setting water rates, whereas efficiency values could be invoked in the decision to buy from Detroit.

In the final analysis, either human behavior adjusts to changes in the environment or the human organism dies. When institutions are viewed as clusters of human behavior, which indeed they are, then it becomes evident that behavior that takes place through institutions must adjust to changes in environmental conditions if the institutions are to satisfy survival and other societal needs. Since institutional behavioral requirements develop in order to reduce uncertainty, there is a tendency to treat these requirements as ends in themselves rather than as means. But if the perception of the uncertainties that the institutions are designed to cope with ceases to be veridical because of changes in environmental conditions, treating the institutional behavioral requirements as ends in themselves will not contribute to adaptation but instead may be dysfunctional for the organism and for society.

If, through the working of the Unseen Hand over time, existing urban organizational configurations were providing satisfactory adjustments to physical, social, and economic environmental conditions, then there would be no function for the student of public administration beyond observing and describing the unfolding of nature. But since this is not the case, his function becomes one of design to achieve more viable organizational arrangements. To accomplish this, boundary values supporting the existing system will have to be changed if the new configuration is to serve as a means of satisfying environmental demands. As suggested in this essay, the redesign process is not an automatic self-generating one but is rather a result of political activity initiated by individuals or groups who perceive the need for change and are willing to initiate the activities which will bring value conflicts to the surface in order to determine whether or not the subsystem boundary values have been set so high by local jurisdictions that they threaten the destruction of the larger system.

In urban water management, it would appear that the redesign problem can be solved to the extent to which water and water-related activities are dealt with in terms of efficiency values. As long as the vendor can divest itself of any political commitment to a particular jurisdiction which might intrude on its efficiency decisions *vis a vis* the particular service offered for sale, the Detroit experience suggests that local jurisdictions are willing to buy rather than make. To accomplish economies of scale and to provide for the requirements of a large metropolitan area it is probable that the vendor must be some form of government corporation, although it is conceivable that private water utilities could enter the competition.

A more critical assault upon the boundary problem is now under way in relation to public education. On the one hand, the local property tax is being challenged as inequitable in its effect on the distribution of resources for the provision of education services; and on the other hand two recent decisions in Richmond and Detroit school districts which had the effect of concentrating black students in city schools have been declared unconstitutional by lower federal courts. These opinions may very well not withstand appeal. But it is significant that the courts are also now focusing upon the design problem of developing organizational frameworks for providing services in urban areas which satisfy values of social equity. While the Detroit metropolitan area has been presented here as a model of boundary penetration for water services purposes, it is also the home of a national movement to oppose busing of school children in order to achieve integration -- another form of boundary penetration.

REFERENCES CITED

Allport, F. H.
1924 Social Psychology. Boston: Houghton-Mifflin.
1933 Institutional Behavior. Chapel Hill,

North Carolina: University of North Carolina Press.

Barnard, Chester I.
1953-54 "The elementary conditions of formal organization." Seminar Paper No. 5. Presented at a Seminar in Operation Research at Johns Hopkins University. Mimeo.

Clarke, J. W.
1968 Environmental and Political Factors Associated with Municipal Reform Policy in Selected Pennsylvania Cities. Ph.D. dissertation, University Park: The Pennsylvania State University, (September).
1969 "Environment, process and policy: a reconsideration." Political Science Review 63: 1172-1182.

Deutsch, Karl W.
1963 The Nerves of Government. New York: The Free Press of Glencoe.

Easton, David.
1953 The Political System. New York: Alfred A. Knopf, Inc.

Gulick, Luther and L. Urwick.
1937 Papers on the Science of Administration. New York: Institute of Public Administration, Columbia University.

Hunter, Floyd.
1953 Community Power Structure. Chapel Hill, North Carolina: University of North Carolina Press.

Katx, D. and R. L. Kahn.
1966 The Social Psychology of Organizations. New York: Wiley.

March, J. G. and A. J. Simon.
1958 Organizations. New York: Wiley.

Martin, P. S.
1968 "Social institutions: a reformulation of the concept." Pacific Sociological Review 11: 100-108.

Mowitz, R. J. and D. S. Wright.
1962 Profile of a Metropolis. Detroit, Michigan: Wayne State University Press.

Meyerson, M. and E. C. Banfield.
1955 Politics, Planning and the Public Interest. Glencoe, Illinois: The Free Press.

Rubenstein, A. H. and C. J. Haberstroh.
1966 Some Theories of Organization. Homewood, Illinois: Irwin and Dorsey.

Steadman, R. F.
1930 Public Health Organization in the Chicago Region. Chicago: University of Chicago Press.

Wengert, N. and George M. Walker, Jr.
1968 "Institutional constraints on the development of a regional water supply system: the case of Detroit." Proceedings, Fourth American Water Resources Conference, American Water Resources Association. Urbana, Illinois.

Wood, Robert C.
1961 1400 Governments. Cambridge, Massachusetts: Harvard.

Chapter Five

Measurement of the Institutionalization Process In Urban-Metropolitan Water Supply and Waste Water-Treatment Programs

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The concept of institutions has often been used as a heuristic device to avoid more penetrating analysis of behavioral interrelationships. Yet the concept seems to be useful in scientific discourse, and the idea of designing institutional arrangements to maximize human achievement seems to be a universally accepted goal of behavioral scientists.

While the most interesting questions have to do with the significance of institutions in the decision-making process, attempts to answer such questions usually become instances of analysis of decision-making rather than analysis of institutions. This phenomenon is traceable to the nebulous character of the institutional concept, which needs to be more precisely defined before its use in analysis can be meaningful. Therefore, this essay is undertaken with that limited goal. If future refinement of this definition results in a commonly accepted notion of what the concept means, then the more interesting questions of the relationship between institutional arrangements and decision-making can be approached with greater clarity and thus more scientifically valid answers to these questions will become possible.

Definition: Institutionalization

One of the principal difficulties with use of the concept of institution in the literature is its use as a phenomenon rather than as a process. If we define and measure the institutionalization process, then the variation in notions about the point in the process at which an institution exists will become less critical, and it will become largely academic if we continue to disagree about the existence of any given institution. As in the relationship of science to scientific method, agreement on the method or process is vital and agreement on labels applied to the data resulting from use of that method are substantially immaterial.

Institutionalization is a process imparting stability to patterns of behavioral interaction within a social system. Any social system (patterned behavior, whether within a group, agency, or organization or between them) entails interaction. The extent of behavioral patterning, the number and relationship of positions within the system, the purposes for which the system exists, the regulations which designate duties, obligations, responsibilities, and expectations of system participants, and the norms or customs not formally codified are variables between systems and within each system. The extent to which these elements persist in the face of forces which could change them is evidence of their stability and hence of the degree to which they have been institutionalized. The problem is to evaluate their resistance to change. Five criteria for measuring reaction to change can be isolated, as follows:

1. *System development, or behavior patterns and their persistence over time.* Discounting acts which are individual behavior not related to system participation, the relative frequency of repetitive actions by participants in the system should yield an indication of the extent of behavior patterning within the system.

A simple tally of repetitive actions, however, would not make clear enough the extent of variation or uniformity in interactional patterns. Members of new agencies tend to interact on an experimental basis both with each other and with representatives of agencies outside their own group but within the system. As the most effective or satisfying patterns of interaction emerge, these become standardized and increasingly meet the criterion of stability which is characteristic of the institutionalization process. The extent to which rules define the relationships is a helpful but quite unsatisfactory measure of the extent of standardization or patterning.

Organizational diagrams purport to identify positions and their interrelationships or linkages. However, a social system need not be one organization only and usually is not. Furthermore, "position" in the sense of status relationship is more variable than organizational diagrams can depict; therefore, an operationally valid criterion for measuring the interrelationship of positions within the system is elusive. Nevertheless, an attempt should be made to specify these interrelationships, since strength of the interrelationship of positions is an excellent criterion of stability.

While persistence of behavior patterns and positional linkages over time would be a good indicator of extent to which institutionalization has occurred, dealing with this characteristic requires detailed historical data on behavior patterns within a system. Usually, this can be only imprecisely evaluated.

2. *System change when change is warranted.* Relative unwillingness of system participants, on their own volition, to change behavior patterns as the need for them changes or disappears is a rough measure of pattern stability. However, the patterns may persist because they are functional (proven) or because they have become habitual or "required" (whether or not they are functional).

If, at any given moment, a system exhibits disproportionately large numbers of non-functional behavior patterns, one may tentatively conclude that institutionalization has occurred, i.e., that behavior patterns have stabilized to a point of relative imperviousness to need for change. This conclusion would be less tentative if historical data were to show that these patterns had withstood pressure for change in the past. But if behavior patterns show any sign at all of resistance to change, to that extent they are stabilized. The "needs" test is one measure of degree of stabilization.

This gross tally of number of non-functional patterns could be refined by measurement of forces working to change the system, but such measurement would be largely a matter of judgment. It would entail an appraisal of changing needs as well as of the extent to which the system demonstrates capability or inclination to meet changing needs.

3. *Dependence of system on legal or managerial dictates.* Laws and rules governing the system may at first constrain behavior, but with the passage of time, behavior patterns set in motion by such regulations may become habitual. "Red tape" in a bureaucracy is an example. If this generalization is valid, then the age of laws or rules governing behavior within a system is a measure of behavioral stability. If laws and rules are relatively recent, then apparent stability of behavior may be illusory and the behavior susceptible to change with amendment or repeal. The longer the regulations have been in existence, the more probable it is that withdrawal of the law or rule would have little effect on the behavior subject to it.

The significance of recent law as an "artificial" constraint on behavior is somewhat determined by the degree to which it is compelling. If, rather than dictating certain required behavior patterns, laws and rules provide "policy guidelines" only, then behavior within a system may have considerable leeway, and the options chosen may reflect behavior which would have developed anyway. To the extent that this can be shown to be the case, permissive laws and rules should be discounted as having little to do with the institutionalization process. However, even compelling laws are sometimes ignored. Further, "informal organization," as a substitute for formal adherence to rules within the system, may itself be stabilized or institutionalized. In any event, the rules themselves, if ignored, have no bearing on the institutionalization process. The very need for conscious control through law is evidence of potential instability in the system.

The extent to which managerial techniques control interactional behavior also has bearing on the "artificiality" of behavior patterns. In simplest terms, when two participants in a system cooperate voluntarily to achieve a mutual goal, a prediction that this interactional behavior pattern will continue over time will be much safer than if the cooperation were enforced by regulations or managerial dictate. While management of interactional behavior patterns is not necessarily an indication that patterns would break down without the management, excessively managed systems may be suspected of lacking self-perpetuating stability. Control in this sense is antithetical to institutionalization; systems *requiring* control are not institutionalized by definition (although the system of control, e.g., government, can itself be institutionalized). Therefore, the extent to which behavior patterns within the system are controlled is a partial measure of instability or lack of permanence of the system's behavior patterns.

4. *Dependence of system on individual personality.* Strength of positions *per se* is evidence of system stability, while excessive individualism within a system is evidence of instability. If system accomplishments clearly depend on the idiosyncratic talents of key people in the system, then replacement of these individuals would jeopardize system accomplishment, or at least induce change in behavior patterns. On the other hand, the perpetuation, regardless of personnel, of positions and most of the roles associated with them is evidence that the system has achieved "a life of its own." This aspect of stability can be partially inferred from historical data demonstrating relative unchangeability of the system through various personnel changes.

5. *System focus on means.* Systems often exhibit a turning inward of objectives for preservation of the system. On the one hand, self-preservation as a goal may be interpreted as evidence that the system is so institutionalized that the system itself has been reified. On the other hand, goals may have turned inward as a protective reaction to threats of dissolution of the system, a case of system instability. How should the existence of self-preservational goals be interpreted? The first interpretation, reification of the system as system, seems valid. Systems are not necessarily unstable simply because they are threatened. On the other hand, when procedures (i.e., means) or maintenance of positions within the system become goals of system participants, this by itself is proof that the system itself has become a firmly entrenched phenomenon. It is no longer dependent upon satisfactory realization of the goals for which it was created but rather may persist simply because participants have a "vested interest" in the continuance of the system as a system. Extent of punctilious devotion to means is a good indication of system stability.

The extent to which stated objectives correspond to objectives inferred from behavior is another test of this phenomenon. The gap between stated objectives and behavior within the system is indicative of a focus on means to the exclusion of purposes for which the system exists. When stated goals are the primary concern, instrumental means are invariably experimental. They are subject to their workability, and there is relatively little to prevent the abandonment of unsuccessful techniques and their replacement by techniques calculated to improve chances of goal attainment. A focus on system goals *per se* is antagonistic to the stabilization of means because realization of goals takes precedence and there is a continual search for better means. When there is a gap between stated goals and the purposes inferred from behavior, "lip service" is suggested, and one may conclude that ineffective means have not been adaptively changed, i.e., that procedures or behavior patterns within the system have, rather, been stabilized.

The Problem of System Identification

The case for use of these criteria should be verified by an attempt to apply them to actual social systems. The institutionalization of activity relating to urban-metropolitan water problems can provide data for testing the applicability of these criteria. Immediately, however, the researcher is faced with a problem which has so far been avoided: how are systems to be identified?

Social systems are related to needs, values, or objectives. All persons having anything to do with any given need are part of the system that attempts to meet that need. Individual objectives which can be fulfilled by one person are not related to social systems, but as soon as two or more people interact to achieve something, a social system exists. This means, of course, that a housewife turning on a water tap, a plumber fixing a leak in a pressure tank, an accountant noting receipt of a water bill, a civil engineer considering alternative sources of water supply, and a federal official reviewing an application for a loan

to a local water department are all part of a water supply service system; so, incidentally, is the president of a manufacturing company whose effluent pollutes the source of water supply, etc.

Each of these individuals may participate in many ways in the same system: The housewife votes and so helps to select the mayor who appoints the water department superintendent; the plumber drinks water; and so forth. Also, each participates in many other systems. In fact, it is often difficult to identify which "hat" is being worn. For example, the civil engineer worrying about future water supply may be thought of as participating in "the water supply planning system" rather than in "the water supply service system." Clearly, the terms "objectives," "needs," and "values" are relative, so that any one person may not objectively identify a system. The existence of a need is to some extent dependent on point of view.

For clarity, therefore, it is necessary to specify what this essay means by the words *problems* or *needs* as they relate to urban-metropolitan water resources. Only by specifying what is here considered as an urban-metropolitan water resource problem can the social systems relating to those problems be identified.

Yet specification of urban-metropolitan water resource needs is only part of the identification problem. As indicated above, everything about behavioral interaction to meet a need entails loops and cycles. Each system of human activity reaches like an octopus into other systems. Systems are mobile and interconnected throughout society. Social systems entail reaction as well as interaction. There is always an arbitrariness in identifying a system for conceptual purposes.

For example, the water supply planning and service system in the City of Boston area is one of the systems which will be discussed in this essay. At the very least, this system includes customers, suppliers, workers, managers, legislators, governors, local officials, consultants, lawyers, judges, bankers, realtors, land owners, news media personnel, and receivers of news. Yet most of the decisions which have bearing on this system are made within one organization: the Metropolitan District Commission. In fact, the importance of this organization as the agency determining the shape of the system, and how it will be maintained, is so great that one is tempted to call MDC "the system." In actual fact, it is only one subsystem within a more complex system for planning and operating a water service in a specific area. Still, it is conceptually simplest to treat MDC as the focal system and to consider other parts of the system (e.g., legislature, town government) as factors affecting MDC rather than as parts of one overall system.

If, using the five criteria discussed above, it can be demonstrated that MDC is relatively stable, then we may say that it is, by definition, relatively institutionalized, and we may be tempted to call it an institution. If so, we will have applied the label of "institution" to a system which, in this instance, is also an organization. This would be an unfortunate association because of the confusion resulting from the interchangeability of the concepts of *organization* and *institution*. Yet every organization is at least a subsystem, and man's intellectual capacity and his language are so limited that some such simplifying procedure must be undertaken in discourse. This is especially true in a short essay where only highlights of evidence can be touched upon. Therefore, in discussing the metropolitan water-supply planning and service system around Boston, this essay will focus on MDC, and the conclusions reached about institutionalization will relate primarily to MDC rather than to the system as a whole.

In some other examples to be discussed below, such a focus on one organization is not justified. The discussion of the water-pollution-control planning systems must include four levels of government and consultants to each, no one of which can be singled out as the focal point in the systems. Therefore, the association of institutionalization with any one organization is unjustified and the systematic aspects of the process will be apparent.

The problem of need identification as the key to definition of systems is complex. In the present case, both "water resources" and "urban-metropolitan" imply certain things about needs which will be focused on to identify systems. The former can be satisfactorily defined by being more specific. Thus, "water supply planning and service" seems adequate to specify one set of water resource needs. However, the concept of "urban-metropolitan" as it relates to needs cannot be so easily handled and warrants further discussion.

Scope of Urban-Metropolitan Water Resource Problems

What is peculiar to urban-metropolitan water resource problems? Most obvious are the advantages and disadvantages of concentrated population. On the positive side is the opportunity population density offers to build interconnected facilities. Regional systems are economically unfeasible in sparsely settled areas. It is often less expensive in rural areas to permit each dwelling or business to put in its own well and sewage disposal system than to attempt the interconnection of dispersed structures to a common source of water supply or waste water treatment. In urban areas, on the other hand, interconnected systems of supply and disposal can almost always be built with economies of scale fully operative.

On the other hand, because of concentrated population, urban-metropolitan areas are often subject to shortages of high-quality water supply, polluting discharges are more damaging, recreational or scenic open space around water bodies tends to be preempted by other uses, flooding is more damaging because high-value structures are concentrated in flood plains, and drainage may become particularly troublesome as macadam and cement replace permeable soil.

Metropolitan problems are compounded by the difficulty of institutionalizing procedures where a multiplicity of local governments seek to safeguard their own prerogatives. The problem of excessive localism is exacerbated by built-in urban-suburban antagonisms. Central city residents are often unhappy with use by suburban residents of central city amenities without suburban tax contributions to the construction and operation of those amenities. Suburbanites are often thought of as wealthy former city dwellers who deserted the sinking urban ship precisely when their wealth or talents were most needed to solve mounting central city problems. Suburban residents, on the other hand, become antagonized by central city attempts to obtain suburban land for central city needs such as airports and water supply reservoirs. Where the suburban population is made up of large contingents of former central city residents who left the city to avoid city problems, attempts to join city with suburb in even the most logical, efficient, and innocuous of programs

is resisted nevertheless on grounds of vague concern over getting involved with city problems again.

Urban problems, while staggering, are more technical than metropolitan problems and hence are more amenable to stabilization of procedures leading to a solution. Given reasonable consensus on goals, simulation models can be constructed to design the best possible programs at the least cost. While there are practical problems of costs sunk in existing services, improving these services and eventually optimizing them, given agreement on goals, is largely a problem of engineering.

In this sense, the label "urban-metropolitan water resource problems" may mislead the investigator. Institutionalization of *urban* water resource programs may require a major focus on the stabilization of *technical* procedures, while institutionalization of *metropolitan* water resource programs may require a major focus on the stabilization of *equity* procedures. The difference should not be overemphasized, but there is, in this one general distinction between "urban" and "metropolitan," a problem of identifying the "system" to be evaluated.

The systems which have been chosen to illustrate application of the five criteria discussed above are systems of water-supply planning and service, and systems of waste-water treatment planning. Choice of these examples was dictated by the writer's familiarity with them and by the contrast they suggest. The two water-supply planning and service systems selected are both metropolitan but differ in degree of apparent stability as measured by the five criteria. The three waste-water treatment planning systems selected are more urban than metropolitan in character, but differ less markedly in degree of apparent stability. An important reason the waste-water treatment planning examples were selected was that they are of comparatively recent origin, thus providing a contrast in time sequence with the water-supply planning and service systems.*

Two Water Supply Planning and Service Systems

The Massachusetts Metropolitan District Commission and the Detroit Water Board have developed extensive metropolitan water supply systems around the cities of Boston and Detroit, respectively. Both systems began in the first half of the nineteenth century. Both have developed water-supply service to an area roughly coterminous with the area of heaviest population concentration around an urban core. (MDC serves approximately 2,000,000 customers in 43 communities, while the Detroit Board serves approximately 4,000,000 customers in 84 communities.) Both systems operate on a quasi-regional basis; that is, they sell water at wholesale to local municipalities, which then retail it through their own distribution systems to the ultimate users. Both systems rely for supply on large-scale development of available water resources. In both cases, the wholesale charge for water is comparable. Finally, both systems grew and developed within a similar democratic governmental framework and under the encumbrance of strong local home-rule traditions.

Given only these facts, one might assume that the institutionalization process had also been similar. Yet this is not the case. As will be demonstrated by the evaluation of the institutional aspects of the two systems that follows, the MDC appears markedly more institutionalized than the Detroit Water Board (Water Board).

1. *System development or behavior patterns and their persistence over time.* MDC's growth has been slow and fraught with equity disputes. The patterns involved in these disputes have been similar and have resulted from the combination of strong local prerogatives, compelling MDC powers, and complex financial traditions. Municipalities have generally resisted membership until they had no viable alternative, except that the 11 municipalities not within the District, which buy their water on a contract basis, were all made part of the system in order to justify acquisition of supply or to compensate municipalities for land taken for supply. Otherwise, all members of the District receive water at a standard price and all are equally subject to the rules and regulations promulgated by the Commission.

The Detroit system has developed "by fits and starts." Until 1956, membership was allowed only through the reluctant acquiescence of the Detroit Board in petitions for membership by communities with serious water-supply problems. In the 1950s, policy of the Detroit Water Board shifted 180 degrees, from reluctant acquisition of needy members to aggressive expansionism. In the last 15 years, the system has more than doubled in size. Before 1956, each case of potential membership was handled separately, and each new community joined under different terms. At present, although managerial costing criteria have been standardized, each prospective member is still "negotiated with" by the Board. Furthermore, there is evidence that the Board plays a substantial role in area development by providing service in advance of need. Until recently, then, the expansion of the water service area has been a patchwork phenomenon.

2. *System change when change is warranted.* In spite of the equity disputes mentioned above and the near-insurmountable problems associated with letting new members into the system, MDC has not changed its membership procedures and requirements significantly in the last 80 years. Prospective members must join if they lie within a given radius of the State House in Boston and need water supply beyond what they have already developed. Yet the terms of membership require payment of an entrance fee to cover the amortized cost of the supply previously developed by MDC. Once in the system, members have no option to get out of it. The prices charged ultimate customers vary excessively, with some communities deriving substantial "profits" for the general fund from water-rate

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* In the following discussion of these examples, the material on Detroit is derived from some first-hand research, but mainly from a publication by George M. Walker, Jr. and Norman Wengert entitled *Urban Water Policies and Decision-Making in the Detroit Metropolitan Region* (University of Michigan, Ann Arbor, July, 1970). The data on Boston is the result exclusively of first-hand research. Much of the material presented here can be found in more detail in Irving Howards and Edward R. Kaynor, *Institutional Patterns in Evolving Regional Programs for Water Resource Management* (Water Resources Research Center, University of Massachusetts, Amherst, 1971). Data relating to Springfield, Holyoke, and Amherst is also first-hand. It stems partly from course materials at the University of Massachusetts and partly from an ongoing research project funded by the Office of Water Resources Research ("Attitudes, Values, and Perceptions in Water Resource Decision-Making Within a Metropolitan Area," WRB 018 MASS.).

revenue. Members are burdened by heavy debts incurred to pay prior deficits caused by failure of the wholesale charge to cover costs of MDC operations. Supply is perenially barely adequate to cover current usage, and restrictions on usage have been enforced in dry years.

After 100 years of "reluctant" growth, the Detroit Water Board adopted a new policy in the 1950s. While the Detroit system still faces equity disputes and rates charged by local municipalities vary greatly, most of the problems resulting from the acquisition of new members have been ameliorated, and supply adequate to the year 2000 and beyond is being developed. Generally, the Detroit Water Board has shown great flexibility in its negotiational procedures, each case of new membership being handled on an *ad hoc* basis. Thus, its adaptation to changing needs can be fairly smoothly accomplished in the absence of legal constraints limiting policy options.

3. *Dependence of system on legal or managerial dictates.* MDC is run by a Commissioner and four Associate Commissioners, all appointed by the Governor. In most cases, this has meant political appointment regardless of qualifications. However, since actual management falls largely to professional staff, the presence of nonprofessionals in top posts has not seriously affected MDC operations. There are no management options; the system is constrained on all sides by detailed state law. Yet almost all of these legal provisions have been operative since the agency was set up, and careful investigation of MDC procedures and attitudes leads one to conclude that even if these laws were repealed, the agency would still do business in the same way.

Perhaps the most noticeable aspect of the Detroit metropolitan water system is that it operates with minimum legal strictures. The Detroit Water Board is a creature of the City. Its charter provides for service to residents of the City, and its authority to provide service outside the City is clearly secondary. Nor does the law spell out how much and in what way regional service is to be rendered; agency management is substantially free to proceed as it deems best. This has been apparent both in the *ad hoc* character of its negotiations with prospective member municipalities and in its ability to shift policy extensively. As does MDC, the appointed Water Board appears willing to follow the recommendations of its professional staff.

4. *Dependence of system on individual personality.* MDC is distinguished by the relative anonymity of its leaders over the years; that is, since commission appointments are for a period coterminous with that of the Governor, commissioners do not last long enough to make a significant mark upon agency administration, and since legal constraints on administration are severe, it is questionable whether major new procedures or policies could be undertaken in any case. MDC is a fairly clear example of a bureaucracy initially set in motion by state law but long since self-perpetuating -- a thoroughly patterned and structured system which could probably not be significantly changed by even the most charismatic leader.

Much of that which is characteristic of the Detroit metropolitan water supply system is a result of the efforts of one man: Gerald Remus, Superintendent of the system for the last 15 years. Mr. Remus has been successful (1) in gaining commitment from a City Board to expand water supply dramatically outside of the City, (2) in preventing raids by the City on the agency's treasury, and (3) in promoting and implementing a major and expensive plan for rapid development. Many impersonal factors have been operative through the life of the Detroit Water Board, but the work of this one leader is a demonstration that charisma is still effective, even in a one hundred-and fifty-year-old agency with a heavy capital investment in an existing system.

5. *System focus on means.* In the MDC operation one is struck with the emphasis on procedures to the relative exclusion of imaginative policy. Recently, the Commission and staff have demonstrated considerable concern for long-range supply needs, and such a concern has also been evident at various times in the past when supply was short. But that concern has been dictated by laws pinpointing the agency's responsibility for service to an area; it has not been supplemented with great concern or debate over expansion or any of the other policy issues usually associated with management of a large enterprise. True, it has been the detailed and compelling features of long-standing law which have forced agency leaders to focus on problems of personnel, equity, and the like rather than on agency programs in the large, policy-determination sense. The regional program is a federation of quasi-independent local units where concern with equitable treatment overpowers any inclination to focus on overall program goals.

While the Detroit Water Board must cope with a similar federation of quasi-independent local units and therefore with a need to negotiate each case, its procedures for doing so are substantially open-ended. In the relative absence of constraining legal provisions, the negotiations can be undertaken within program guidelines, and speed of expansion of quality of service may take precedence over considerations of equity in the negotiational process. That the Detroit Water Board does indeed pay attention to program goals is evident in the extent of long-range planning. Evidence of planning up to the year 2000 appears in documents dated 1956, 1959, and 1966, and these sweeping plans for development continue to be updated. No such sweeping plan has been published by the MDC in the twentieth century. Its last published plan, in the late nineteenth century, was largely the work of the Massachusetts Department of Public Health, not MDC itself, and it was "sweeping" only with regard to the planning of supply and not with regard to territory served.

Both MDC and Detroit Water Board spend considerable time and effort worrying about rates, costing criteria, land acquisition, compensation payments, system maintenance, and personnel problems. However, in the Detroit Water Board this effort is secondary to, and reasonably balanced with, larger questions of agency development policy, while in MDC relatively little attention is paid to such questions.

These summary reviews of institutionally salient characteristics of two comparable urban-metropolitan water-supply planning and service systems are necessarily brief and thus lack supportive detail. Also, other participants in the systems (e.g., state legislatures) have been ignored. Nevertheless, when viewed even in this general fashion, differences in the extent of institutionalization are notable with regard to each criterion. Using what has been focused upon here as the critical aspect of the institutionalization process -- namely, stability of system -- MDC appears as markedly institutionalized, while the Detroit Water Board appears comparatively devoid of institutional characteristics.

These summary findings also highlight the difference between organization and institutionalization. For those who think of institutions as accepted, legitimized, or organized ways of meeting a need, it may appear bizarre *not* to call the Detroit Water Board an institution. It is, after all, a complex management system for supplying water to a large area. It is accepted, it has been in existence for a century and a half, and it is firmly entrenched as *the* system to meet a critical need in the Detroit region. There will be no argument if the reader wishes to call this an institution. But by defining an institution as a process instead of a thing, the author of this essay hopes to help avoid such arguments; in such a definition, opinion with regard to the moment at which an institution comes into being is not considered a question at issue. All that the preceding evidence intends to show is that the Detroit Water Board, while well organized, lacks certain distinctive features which, it is believed, most people would associate with the process of institutionalization. In terms of the definition established here, it is considerably less institutionalized than the Massachusetts MDC.

The point in time when evaluation is made may also cause some confusion; that is, had the Detroit system been evaluated prior to the policy upheavals of the 1950s, many of the features which have here been called relatively noninstitutional would not have been apparent. This confusion dissipates if one keeps in mind the idea of institutionalization as a process. If a process is insisted upon rigorously as the proper focus of attention, it should be evident that institutionalized systems once relatively institutionalized can move in the opposite direction. While the criterion of stability is antithetical to the idea of decreasing stability once it has been attained, it is obvious on reflection that once-stabilized systems may nevertheless become less stable under conditions of changing conditions. Revolution is the extreme example. It is, therefore, not impossible for a system such as the Detroit region's water supply to become more dynamic or more unstable in the face of conditions which upset its previous equilibrium as an institution. While one may believe that the Detroit Water Board had never attained a degree of stability comparable to that of the Massachusetts MDC, evidence supports a conclusion that the Board's policies and procedures are less institutionalized (more dynamic) now than was true at the end of its first century of operation.

Three Water-Pollution-Abatement Planning Systems

While systems roughly comparable to the present one for construction of waste-water treatment facilities have been in existence since the 1930s, the 1948 Water Pollution Control Act and the 1956 amendments thereto, the 1965 Water Quality Act, and the 19 6 Clean Waters Restoration Act were unusually comprehensive instances of administrative law. These Acts and the complementary Massachusetts Water Quality Act of 1966 set up in considerable detail the manner in which water-pollution-control facilities in Massachusetts were to be planned and built. The relatively recent enactment of these laws and the even more recent shift in responsibility for carrying them out to a new federal agency, the Environmental Protection Agency (EPA), preclude the possibility of investigating in any conclusive way the apparent persistence of system patterns. Nevertheless, incipient institutionalization of water-pollution-control planning procedures can be evaluated. The City of Springfield, the City of Holyoke, and the Town of Amherst in Western Massachusetts have all had experience with such an administrative system, and some of these experiences suggest differences in the extent to which institutionalization of waste-water treatment planning is occurring.

1. *System development or behavior patterns and their persistence over time.* While the system development patterns are too recent to be adequately evaluated, there is some evidence that they have been better stabilized in Springfield than in the other two communities. This finding is somewhat unexpected, because the Springfield plan is broader, more regional in its scope, than the other two. Because Springfield is more urban than Holyoke or Amherst, its plan requires not only a more complex design but also attention to metropolitan considerations of greater scope than Holyoke's and of much greater scope than Amherst's. Springfield's population exceeds 150,000, Holyoke's is close to 50,000, and Amherst's is less than 30,000. Further, although industrial waste water problems are notably evident in both Holyoke and Springfield, Amherst has practically no such problem. One might therefore expect Springfield's waste-water-treatment planning problems to be greater and consequently its planning procedures to be more complex and less stable.

Springfield's planning problems have indeed been the most complex, with Holyoke's and Amherst's following, in that order. However, degree of complexity appears to have had little to do with standardization of planning procedures; the planning system has been similar in all three. In rough outline, the Massachusetts Water Pollution Control Division set planning and construction implementation schedules. The local communities hired consultants to draw preliminary design plans. After these were tentatively approved by local legislative bodies -- the local regional planning agency, the Division, and the federal agency officials -- consultants then proceeded with final design planning in the expectation of final approval by the same agencies and subsequent construction with 55 percent federal funding, 25 percent state, and 20 percent local.

However, the uniformity suggested by this rough outline of planning procedures is deceptive; in actual practice the patterns varied somewhat. All three communities were operating primary treatment plants when the state issued its implementation schedules for secondary treatment. The abandonment of Amherst's primary treatment plant triggered a local controversy which resulted in the formation of a Technical Advisory Committee to work with consultants and town officials. Neither Holyoke nor Springfield set up any such novel planning agency in spite of the fact that they had greater problems of negotiation with industry and neighboring communities than did Amherst. The question of who has authority to do what in the town of Amherst is less close to being resolved than it is in either of the two cities.

2. *System change when change is warranted.* Although Amherst did experiment with the use of a new planning procedure, it cannot be said that willingness to change when change appears desirable has been evident in any of the three cases under review. Objectors to Amherst's preliminary plan cited six major points of contention: (1) the total abandonment of existing capital investment in sewage treatment, (2) the plan to incinerate rather than reclaim sludge, (3) the "self-fulfilling prophecy" aspects of providing sufficient sewerage and pumping-station capacity to justify the size of the proposed plant, (4) the failure of the plan to include sewage from the town of

Hadley within which the plant was to be built, (5) the absence of tertiary treatment expansion capacity in case federal or state standards were tightened, and (6) the failure of the "traditional" plan to take advantage of new technological breakthroughs in treatment techniques, recycling of sludge, and use of methane as a power-producing byproduct. Given the technical sophistication of these objectives, town leaders had substantially no political alternative to cooptation of objectors into the planning process. However, the Technical Advisory Committee has not been given authority beyond making recommendations, and final design planning is proceeding as though the preliminary design plan were the unequivocal basis for final specifications. In other words, sporadic conflict between the Technical Advisory Committee and consultants or town officials is the only deviation so far from a "typical" set of local sewage-treatment planning procedures in Amherst. The Amherst planning system has demonstrated strong resistance to change so far.

No similar "public uprising" has occurred in either Holyoke or Springfield. Therefore there is no self-evident political reason for innovation in sewage-treatment planning procedures in either city. However, there has been some evidence of resistance to change in both cities.

In Springfield, resistance to change can be inferred from the behavior of participants in the planning process. First, it should be noted that Springfield's regional plan includes treatment of sewage from the adjacent towns of Ludlow, East Longmeadow, West Springfield, and Agawam. Given existing population concentrations and the location of existing sewer pipe, this collaboration makes sense in terms of economies of scale; but using the same criteria, it is not immediately apparent why other adjacent cities and towns -- Longmeadow, Wilbraham, and Chicopee -- are *not* included in the plan. Springfield's Superintendent of Streets and Engineering has expressed grave doubts about the failure of the plan to include the Town of Wilbraham in particular. He has reported that his letters to state and federal agencies advocating the inclusion of Wilbraham have been ineffective. In point of fact, Wilbraham consultants and town officials have simply refused categorically to consider including the town in the Springfield system.

A more clear-cut example of resistance to change can be inferred from the behavior of the Springfield City Council when it was presented with a $55,000,000 sewage-treatment plan -- a figure as high as that of the city's entire budget for a year; and yet, when a City Councilor arose to ask, "Does anyone know what the dickens we're doing?" he received no reply. He then sat down, and the $55,000,000 authorization passed, on voice vote and without further comment. Had there been any doubts about the system, an appropriation of this magnitude would surely have been discussed.

Holyoke has, in the past, demonstrated considerable ingenuity, especially in its approach to political problems. The planning of the City's primary treatment plant in the 1950s is a good example. Under Public Law 660 as amended in 1956, the City applied for and obtained approval of the maximum federal grant of $250,000. When Congress later increased the maximum grant authorization to $600,000, Holyoke immediately reapplied, but federal officials insisted that the $250,000 allocation amounted to a binding contract. There ensued a lengthy period of conflict, finally resolved by Holyoke's receipt of a $1,000,000 federal grant under the Accelerated Public Works program of 1962. In the words of Holyoke's consulting engineer:

> Every community (and I'll say this honestly) under our guidance and our advice are playing the game, waiting to get the best federal and state grants.

However, no such unwillingness to accept the system as legislated by higher authority has been evident in Holyoke's more recent planning procedures for secondary treatment. The City's consultants have objected on technical grounds to state insistence on the inclusion of South Hadley's sewage in the system, and the inclusion of manufacturers' discharges has required some moderately hard bargaining, but the planning procedures have remained intact as initially designed in spite of these pressures for deviation.

Applying the criterion of change in procedures to meet changing needs shows all three municipalities exhibiting surprising stability, especially in light of the newness of the laws setting up the procedures.

3. *Dependence of system on legal or managerial dictates.* Although it is too early to say that existing sewage-treatment planning procedures would stay the same if the laws setting up the system were repealed or withdrawn, the above discussion of change indicates that all three of the communities here reviewed exhibit commitment to the program. One may suppose that withdrawal of state and federal requirements, and particularly state and federal grants-in-aid, would stop or at least greatly reduce local planning efforts. Yet the program itself appears to have had a band-wagon effect on local attitudes toward pollution. It would not be surprising if all three of these communities continued water-pollution-control planning on a reduced scale even without state or federal participation.

4. *Dependence of system on individual personality.* State and federal law on the construction of wastewater treatment facilities is largely unequivocal, and changes in regional, state, or federal personnel appear to make no difference (although some local Amherst officials look upon the recent retirement of a certain state official with expressions of relief). Furthermore, it appears to make little difference which consulting firm is chosen by local communities. Design criteria are quite specific and thus leave consultants little room to deviate from minimum standards. Since most communities insist on the least expensive design within minimum standards, there is a tendency toward sameness of plans irrespective of who draws them.

However, type of community and degree of interest taken by the local public appear to be an important variable. In Amherst's case, both controversy over technical aspects of the plan and creation of the Technical Advisory Committee may be attributed to the disproportionate number of citizens who are affiliated with the University of Massachusetts and local colleges. Specifically, two microbiologists at Hampshire College became interested through field studies of the Amherst primary treatment plant made as part of their course instruction. Their questions, the importance of which was confirmed by other members of the local academic community, triggered the controversy which resulted in the present unusual citizen-review procedures in the planning process. No such controversy has arisen in either Holyoke or Springfield, perhaps because of a general reluctance on the part of citizens to become involved in highly technical questions of design engineering. However, it should be clear that had those cities contained similarly motivated citizens with technical competence, similar effects on the planning process could have resulted.

In spite of this finding, the Amherst controversy has not, as noted previously, greatly changed planning procedures. In all three cases, the waste-water-treatment planning system has demonstrated remarkable inperviousness to change, thus confirming previously cited evidence of system stability.

5. *System focus on means.* In the cases under consideration, applying the criterion of the system's focus on means may be considered somewhat "unfair." The waste-water-treatment program in general has a set of specific goals that have to do with the classification of receiving waters, but the planning of sewage treatment facilities is at present an end in its own right. The system intends to focus on means, on the presumption that ends are given.

On the other hand, punctilious devotion to procedures and deadlines to the relative exclusion of quality of design is valid evidence of institutionalization of procedures in any planning program. Local Amherst officials have expressed dismay over the idea of objectors in general, not because their objections are invalid, but because any deviation from the implementation schedule jeopardizes the 80 percent state and federal subsidy. One Springfield City Councilor, when interviewed after passage of the $55,000,000 authorization for sewage treatment, suggested that Springfield's share, amounting to less than $12,000,000, was a "bargain." Holyoke's consultants protested the inclusion of South Hadley in the Holyoke program partly on grounds of cost, but also on the grounds of delay in the planning process. Wilbraham's only expressed reason for not entering the Springfield system was that its preliminary plan had already been drawn.

These are not overpowering evidences of devotion to procedures, but they at least indicate that the goals of each of the planning programs have been to some extent subordinated to considerations of time, money, and maintenance of the planning system *per se*.

Thus, on the basis of all five criteria of stability each of these three instances of waste-water-treatment planning exhibits some degree of institutionalization. Given the relatively recent enactment of administrative rules governing the procedures, it is not possible to predict whether or not institutionalization will continue to increase; but if what seems to be a firm start is any indication of things to come, then institutionalization to an extensive degree should occur at a very rapid pace.

Further confirmation that institutionalization has already taken place may be found in EPA's experience with "turn-key" procedures. In mid-1971 the EPA Administrator solicited comments on EPA's intention to permit turn-key procedures for planning and constructing waste-water-treatment facilities. These would give one firm full responsibility for planning and constructing facilities under federal guidelines and would guarantee performance of the facility constructed.

According to EPA officials, response to this proposal has been overwhelmingly negative, especially from consulting engineers. Nevertheless, EPA has proceeded to adopt modified turn-key regulations on a permissive basis. The only problem, according to one EPA official, is that he is usually unable to detect how purported turn-key cases differ from those employing the traditional procedures described in the preceding analysis of waste-water-treatment planning in Amherst, Holyoke, and Springfield. In other words, planning procedures formally in existence only since 1966 have become so institutionalized that the federal agency most closely associated with those procedures finds it extremely difficult to change them in any substantive respect.

It appears possible, then, to evaluate social systems in terms of the degree to which they have become institutionalized, using as criteria various measures of system stability. The case for the desirability of this five-criteria approach might have been more convincingly made if the five criteria had actually been used as research guides in a study of the systems used as examples. Nevertheless, even though the data available are fairly general and random, use of this approach has perhaps produced a case for classifying the Detroit metropolitan water supply system as comparatively less institutionalized than the Boston metropolitan water supply system and for classifying water pollution control planning efforts in three Massachusetts communities as well institutionalized in spite of the fact that they are relatively recent phenomena involving complex interaction at four levels of government: local, regional, state, and federal.

Conclusion

In this essay the author has attempted to develop a series of criteria for evaluating a process which has been called institutionalization. Its aim has been to demonstrate that a nebulous concept can be made more precise and hence more useful in both research and dialogue. However, since the criteria themselves are conceptual, any degree of agreement still rests on the assumption that the author's criteria are acceptable as those most salient for the process. The author hopes the reader will accept the criteria specified as valid measures of the institutionalization process. Further refinement of these criteria in the future or the development of other criteria may more closely approximate basically acceptable notions of what is involved in the process. This essay should thus be looked upon as a first step toward viable specification.

After the criteria and the rationale for their choice were presented, an attempt was made to apply these criteria to examples of urban-metropolitan water resource programs in the Northeast. Since the data at hand in these examples had been obtained by the author during prior research which did not focus on the criteria, his findings were quite general and rather imprecise for present purposes. Nevertheless, they have demonstrated that these five criteria can be usefully applied to real-life instances of urban-metropolitan water-resource planning and development. The next task will be to determine how the institutionalization of these urban-metropolitan water-resource systems affects the decision-making process in each case. The question whether institutionalization is constraining or helpful for decision-making is the crucial question needing further research and analysis.

Chapter Six
Institutions and Urban Water Management

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As Norman Wengert has pointed out, the terms "institution" and "institutional" have been used very loosely in most writings on water-resources policy, planning, and management. This author pleads guilty to this loose usage in his recent writings on urban-metropolitan water-resource planning. Wengert's critique of this usage has led me in this paper to attempt (1) to examine the *utility* of the term and (2) to derive an *operational* definition of the term suitable for writings on urban water problems and issues.

Utility

We can approach the issue of utility by asking: Would the information sought to be conveyed be significantly reduced by dropping the term and substituting other terms to convey the intended meaning? Specifically, can we substitute for "water-resource institutions," and "urban water institutions," such terms as "water-resource organizations," "water-resource administrative structure," or "urban water-resource agencies"? Or does the term "institutions" convey information that cannot be provided as effectively by a set of terms with more specialized meanings?

I shall address this question directly by analyzing the use of the term "institution" in my January, 1971, research report to the Office of Water Resources Research on urban-metropolitan water-resource planning (Hufschmidt and Elfers, 1971). Because of the report's subject matter, it should offer a fair test of the value of the term "institutions" in conveying information essential for urban water management.

An analysis of the four relevant chapters of the report (Chapters I, II, III, and VIII) reveals that the term appeared but 18 times in 95 pages of double-spaced, typewritten text. Some of these instances were merely references to use of the term in other reports; others were essentially duplicates, that is, they appeared as restatements of a concept such as "institutional constraints." It is fair to conclude that the term was used in a subsidiary, almost incidental, manner throughout the report. In its place primary reliance was put on the terms "organization" and "administration."

Although the terms "institution" or "institutional" were nowhere defined in the report, the core meaning was close to the meaning of "organization," "organizational pattern," or "organizational structure." Thus, on page 25 of the report an example of a planning guide was given as:

> . . . constraints arising from political and *institutional* factors such as interstate relations, federal-state relations, and international relations. The institutional factors here refer to the organizational patterns and related arrangements central to interstate, federal-state and international relations. (Italics added.)

Distinctions were often made between the term "institutional" and the terms "political," "governmental" and "administrative." In some cases "institutional" was used as a term almost synonymous with "governmental," as on page 271, where reference is made to "continuing Federal activity in sponsoring and promoting research on the physical, economic, social, and *institutional* aspects of urban and metropolitan water resources" (italics added).

We can conclude that the term "institutional" was not *required* in this report to convey the information on urban and metropolitan problems that was intended. Skillful use of such terms as "public and private organizations," "associations," and "formal arrangements" would have filled the requirements. The term is *convenient*, however, and its consistent use, according to an explicit definition, would have improved the style and clarity of the report. It must be recognized, however, that this report was not concerned primarily with the governmental structure and the public and private organizational arrangements which are almost always at the core of "institutional" research and analysis. The question as to the general utility of the term therefore remains open.

In his recent report on institutional arrangements for water resource development written for the National Water Commission (Ostrom, 1971), Vincent Ostrom places the term at the center of his analysis. Although nowhere explicitly defined in the report, "institution" is used quite consistently to cover both private and public social organizations such as the market system, viewed as a form of private economic organization, and public water-resource organizations. Given this operational definition and the emphasis of the report on social arrangements for meeting water-resource goals, it is hard to see how the term could be dispensed with without a significant sacrifice of clarity.

Lyle Craine, in an analysis of institutions for managing lakes and bays (1971:519-546), has provided us with a definition of the terms "institutions" and "institutional arrangements" as follows:

> . . . a definable system of public decision-making [which] includes specific organizational entities and governmental jurisdictions, but transcends conventional emphasis upon definitions of agency structure, per se. The term "institutions" suggests special attention to the configuration of relationships (1) established by law between individuals and government; (2) involved in economic transactions among individuals and groups; (3) developed to articulate legal, financial and administrative relations among public agencies; and (4) motivated by social-psychological stimuli among groups and individuals.

This complex definition is consistent with Ostrom's operational definition referred to above. Craine actually uses the term in analyzing the complex of

of governmental organizations -- regional, special-purpose, and general-purpose -- concerned with management of lakes and bays. Thus, the core of his definition is applicable also to public organizational arrangements, structure, and function.

Finally, the term "institutional arrangements" appeared in a recent report of a committee of the National Academy of Sciences on problems of international environmental cooperation (NAS, 1972). In this report the term refers almost solely to international organizational arrangements, and the distinction between "organization" and "institution" is very tenuous. In this case at least, the information sought to be presented on problems and issues of international environmental cooperation is not significantly diminished by avoiding the term "institutional" and using more specific terms such as "organizational."

From this very brief survey of current examples of the use of the term "institutional," one can conclude that it has utility when the scope of the analysis is significantly broader than public organizational issues and includes such social phenomena as the market system, class and ethnic relationships, and cultural and professional entities. Urban water management is likely to involve such broader issues and social phenomena to a significant degree. Thus we conclude that the term "institution" should not be dropped, but that efforts should be made to develop an operational definition of it for research and analysis on urban water management.

Operational Definition

In approaching an operational definition of the term "institution" for urban water management, we accept Wengert's statement that use of the term as a convenient synonym for "organization" is unacceptable. On the other hand, no attempt will be made here to construct a rigorous definition of "urban water institution" *a priori*. Rather, by means of specific examples of "social systems" (as this term is defined by Mayer*), candidates for inclusion in an operational definition will be examined and either chosen or discarded. Only then will we attempt to construct a reasonably consistent definition of the term as applied to urban water management.

Two subcategories will be used in the analysis of social systems as candidates for acceptance as institutions of urban water management. The first is *urban water institutions* as such, that is, social systems whose reason for being is congruent (or substantially so) with urban water management, where the term "urban water institutions" is used to cover the broad domain of urban water policy, planning, development, regulation, management, operation, and research.

The second is *institutions related to urban water management*, including social systems not qualifying for the first sub-category, nevertheless are concerned with urban water management to more than an incidental or trivial degree.

Examples of Urban Water Institutions

Clearly the *water supply agency* of an urban area qualifies as an urban water institution. This is true whether the agency is public or private, an independent organizational entity (such as a department of a city government or a metropolitan authority), or a subordinate unit of a larger organization (such as a Public Works Department, Environmental Quality Department or Water and Sewer Department, or whether it has complete jurisdiction over the urban area or shares it with other water supply agencies.

Similarly, the *sewage disposal and treatment* agency qualifies as an urban water institution, again whether it is public or private, an independent or a subordinate unit, a single unit or one of a number of similar units in the urban area.

By extension, any other formal organization whose functions and responsibilities are substantially congruent with the domain of some aspect of urban water management can be classed as an urban water institution. Thus a unit of the City Public Works Department that has responsibility for urban storm drainage is an urban water institution; in contrast, the Public Works Department as an entity does not qualify under this classification scheme because its functions are broader than those of urban water management. For the same reason, a City meteorological office which provides information on past, current, and predicted precipitation is not an urban water institution. Special-purpose organizations such as irrigation districts, flood control districts, small watershed districts, drainage districts, or water management districts, whether public or private, that have their principal activity in, or supply services to, urban areas qualify for inclusion.

Generalizing from these examples, we can state that any formal organization whose sole or dominant activity is executing some aspect of urban water management is an urban water institution. A distinction must be made between the specific organization as it may exist at a point in time and the generic type of organization. Thus, every city with a central water-supply system or systems is served by some type of water supply organization, whose form, nature, and relationship to other urban organizations may change over time. The essential permanence of the organization concerned with urban water supply qualifies it as an *institution* of urban water management.

So far, the classification has been straightforward. We now move to kinds of social systems whose interests are substantially congruent with the domain of urban water management, but which have no direct management responsibilities.

The first of these is the professional association: The American Waterworks Association is clearly an urban water institution, as is the Water Pollution Control Federation, composed of professionals in water quality management. In contrast, the Hydraulics Division of the American Society of Civil Engineers, a specialized professional unit of civil engineers, does not qualify because the interests of the unit are broader than the domain of urban water management. A special group of ASCE such as the Urban Water Research Council may be classed as an urban water institution if it achieves essentially permanent status.

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* "By social system is meant any patterned social interaction or interdependency which persists over time" (Mayer, 1972:131).

The second is the association of public officials (e.g., National Conference of Mayors) or composite association of urban organizations, professionals, and bureaucrats (e.g., National Municipal League). No examples come to mind of any such organizations exclusively concerned with urban water problems and issues.

The third type is the special-interest group exclusively concerned with urban water issues. Although there are many special-interest groups concerned with water management issues in general (National Waterways Conference, National Rivers and Harbors Congress, National Reclamation Association) and many others concerned with urban problems and issues (National Association of Real Estate Boards, Urban League), few, if any, special-interest groups are concerned solely with urban water management. Private groups lobbying against fluoridation of urban water might be possible candidates, if they turn out to be more than transitory in nature. An association of cast-iron pipe manufacturers organized to fight the introduction of plastic pipe in water and sewer systems might also qualify. However, most special-interest groups, including the so-called "public interest" groups such as the League of Women Voters, Common Cause, and "public interest" law firms concerned with environmental issues, have broader concerns than just urban water management.

The fourth type is the private business whose sole or dominant concern is some aspect of urban water management. A consulting engineering firm whose major professional activity is in urban water supply or sewage and waste-treatment planning, design, and construction is an example. Another is a firm specializing in manufacturing water meters or in complex equipment for water or waste treatment plants. Still another example is a financial service organization specializing in municipal water supply bonds.

Up to this point we have been concerned with formal organizations, public or private, directly or indirectly concerned with actual urban water management, but with sole or dominant concern for some aspect of urban water management. In addition there may be an informal network of relationships among professionals, bureaucrats, politicians, lawyers, financiers, private businesses, and interest groups with a common concern for some aspect of urban water management and a substantial degree of permanence. The network of relationships that existed in New York City from 1920 to 1970 with respect to providing new water supplies for the city from the Delaware and Hudson river basins is a case in point. This network was part of the *institutional structure* of New York City water management. There are many other examples, among them water supply and flood control in Los Angeles, water supply and sewage collection and treatment in the Washington, D. C., metropolitan area, and water supply and waste management in Chicago.

It is obvious that such examples of social institutions as the family, the church, the social association, the school, and (if these can qualify as institutions) the legal systems and the market system all have concerns broader than urban water management and hence do not meet our narrow criteria for a water-management institution.

This exhausts the examples of candidates for social systems that have exclusive or dominant concern for some aspect of urban water management. Many others qualify as institutions that are related to urban water management; important examples of these will be discussed in the next section.

Related Institutions

In this subcategory, the criterion that the social system must have sole or dominant concern with some aspect of urban water management has been relaxed. All a social system requires to qualify as an institution related to urban water management is a non-incidental or non-trivial concern with some aspect of the subject.

Urban public agencies. In a typical urban government, the Public Works Department would qualify as a *related* institution if one of its functions were the design, construction, and maintenance of sewers and water lines, even where these were provided as a service to a separate water and sewer agency. Also, the planning and budgeting agencies of urban government would qualify because of their concern for overall planning, programming, and financial management. In particular, urban planning and zoning agencies would be included because of the close relationship between decisions on land use and on water-supply and sewage disposal and treatment systems. Other urban entities such as public park and recreation agencies may also qualify; in fact, all relevant urban public agencies as they are formally related to each other comprise the local, public, institutional structure for urban water management.

State public agencies. Agencies at other levels of government have specific responsibilities for one or more aspects of water management that are of concern to urban areas. At the state level, for example, the State Health Department will, typically, be responsible for establishing and enforcing health standards for drinking water and for urban water bodies; often a water-quality agency will have authority to set water-quality standards for urban streams and lakes. Other state agencies may be concerned with allocating loan or grant funds for urban water investments, with river-basin planning, with the administration of water rights, and with regulation of stream uses and modifications of regime. In a few cases, interstate commissions such as the Delaware Basin Commission have water-resource planning, regulatory, and development authority of direct application to urban areas.

National public agencies. At the national level, practically all the water and water-related agencies have programs and activities more than incidentally concerned with urban water management. Among them are the Army Corps of Engineers, Bureau of Reclamation, TVA, Geological Survey, Soil Conservation Service, Office of Water Resources Research, Farmers Home Administration, Environmental Protection Agency, and Department of Housing and Urban Development water and sewer grant and loan programs.

As do local public agencies, state, regional, and national governmental agencies with activities significantly related to some aspect of urban water management qualify as *related institutions*. In fact, the complex of such local, state, regional, and national agencies comprise the public institutional structure for water management.

Non-governmental associations and organizations. Once the strict criterion of sole or dominant concern for urban water management is relaxed, a wide variety of non-governmental, non-profit associations and organizations qualify as *related institutions*. Public-interest groups such as the League of Women Voters, special interest groups such as the National Waterways Conference, Inc., professional groups such as the American Society of Civil Engineers and American

Institute of Planners, environmental groups such as the Sierra Club and Friends of the Earth, non-profit research organizations such as Resources for the Future, Inc., and others are included in this category. Included also are the water-related teaching, research, and extension functions of "institutions" of higher learning, public or private, including inter-university associations (such as the Universities Council on Water Resources) concerned with water resource research and education matters. The distinguishing characteristics of the group are (1) their non-governmental, non-profit nature and (2) a significant but less than total or dominant concern with issues of urban water management. Obviously, the degree of concern will vary widely among the many candidate associations, but in any specific urban situation it should be possible to determine some reasonable cut-off degree of concern that is judged to be non-trivial.

The private sector. Clearly, according to the approach taken here, the market system as an institution is too general a concept to qualify as an institution related to urban water management. Market-type organizations and relationships *do* qualify, however. Many private consulting engineering organizations specialize in planning, design, construction supervision, and management services for urban water management. The construction industry includes firms that specialize in large-scale engineering works related to storage, transmission, and disposal of urban water. Financial markets and the legal profession include firms specializing in local revenue and general-obligation bonds used extensively to finance urban water investments. Many private firms specialize in products and equipment essential to urban water supply, waste-water management, and storm drainage. These planning, engineering, legal, financial, manufacturing and commercial firms, and their professional and trade associations, with their network of relationships, constitute an institutional structure in the private sector that is closely related to urban water management.

General social institutions. We reiterate here that such general social institutions as the church, the family, the specialized associations, including ethnic, race, class, and special purpose (such as sports, amusement and cultural) groups are only tenuously related to urban water management and thus need not concern us here. Also, social systems such as the market system, the legal system, and the political system are not relevant to our purpose. These institutions and systems do have great influence on the social, economic, and political environment within which urban water management is carried out. Thus, for example, the family, in contrast to the commune, is the consumption unit for urban water supply; the church may in some instances be the focal point for resistance to fluoridation of urban water supplies; sports groups such as fishing and sailing clubs may exert pressures for specialized uses of urban water resources. The market and legal systems provide the framework for many allocation and management decisions in the field of urban water. But these institutions and systems also do this for almost all other social-system activities of man; hence, they need not be considered as institutions that are central to or directly related to urban water management.

Tentative Definitions

From the previous discussion of social systems that are involved to some degree with urban water management it should be possible to formulate some definitions of institutions in the context of urban water management.

The first is a definition of an *urban water management institution.* Combining some generalizations made in the first part of this paper, we arrive at the following: An urban water management institution is either (1) a formal organization, public or private, of a substantial degree of permanence, whose sole or dominant concern is, directly or indirectly, some aspect of urban water management; or (2) an informal network of relationships among individuals and/or formal organizations with a sole or dominant common concern with some aspect of urban water management, where this network has attained a substantial degree of permanence. The term *formal organization* has the meaning of "planned system of cooperative effort," as suggested by Simon, Smithburg, and Thompson (1950:5). The terms *public* and *private* are self-explanatory, although there are private (e.g., non-governmental) non-profit and private profit-seeking organizations. By *substantial degree of permanence* is meant time measured in years and decades rather than days or months, with ten years being a reasonable lower limit. *Dominant concern* means more than 50 percent; perhaps 75 or 80 percent is a reasonable lower limit. The term *directly or indirectly* relates to whether the social system in question has authoritative responsibility or merely has influence on some aspect of urban water management. An *aspect* of urban water management is defined as a significant sub-unit of activity, such as planning, design, financing, development, construction, operation, dissemination of information, administration, and research. *Informal network of relationships* means the unorganized or loosely organized linkages, between actors with common stakes in outcomes, that exert influence on decisions in the urban-water field.

This definition is not as rigorous as one would like, even with its attempt to define sub-terms. It does, however, go beyond the definition of formal organization to include informal arrangements and relationships. It requires that organizations and relationships be long-lived, which in the urban-water context is considered to be at least a decade. It also requires that the organizations and relationships have dominant (75 to 80 percent) concern for some element of urban water resource management.

The second definition is of the term *institution related to urban water management.* We can construct this definition by making some modifications in the previous definition to arrive at the following: An institution related to urban water management is either (1) a formal organization, public or private, of substantial degree of permanence, with significant or non-trivial but less than sole or dominant concern, directly or indirectly, with some aspect of urban water management; or (2) an informal network of relationships among individuals and/or formal organizations with significant but not sole or dominant common concern with some aspect of urban water management, where this network has attained a substantial degree of permanence.

The only new term requiring definition here is *significant or non-trivial* as applied to degree of concern. By this is meant (1) concern over important issues or questions of urban water management and (2) social interaction with the urban water management domain with a frequency of at least once a year.

This definition is even looser than the first because it is not possible to draw a sharp line between social systems that are significantly related to urban water management and those that have only an incidental

relationship. In the context of any particular case, however, it should be possible to draw a reasonable distinction by using this definition.

A third definition follows from these two. It is of the *institutional structure* of urban water management. The network of relationships between urban water management comprises the institutional structure of urban water management. We can view this institutional structure as consisting of all of the social systems, formal and informal, of enduring nature, that have a significant interest in urban water management as they are related to each other in action.

This definition, too, is far from rigorous. But by emphasizing structural relationships among social systems, high degree of permanence, inclusion of formal organizations and informal arrangements, and a significant relationship to urban water management, a reasonably precise boundary has been established that can be used in examining a specific case of urban water management.

Concluding Note

This emphasis on an operational definition has led us far away from the sociologist's broader definition of *institution* as discussed in the paper by Ed Knop. In my view, however, the terms "institution" and "institutional" have become so commonly used as an extension of the notion of organization in writings by political scientists and economists on water resources, natural resources, and environmental topics that it is better to develop an operational definition of the term to be used in these contexts than either to abandon its use or to define it in the broader terms used by some sociologists. If it is defined in the context in which it is used, there need be no confusion with the broader and more varied meanings of the term as used by sociologists.

In any event, this exercise in definition of the term "institution" has taught me (1) to avoid use of the term where a more specific term such as "organization" will serve as well, and (2) to use it only along with a definition or at least use it in such a way that a clear and consistent meaning can be drawn from the context.

REFERENCES CITED

Craine, Lyle E.
1971 "Institutions for managing lakes and bays." Natural Resources Journal II (July): 519-546.

Hufschmidt, M. and K. Elfers.
1971 Water Resource Planning in the Urban-Metropolitan Context. OWRR (January).

Mayer, Robert.
1972 "Social systems models for planners." JAIP 38 (May): 131.

National Academy of Sciences.
1972 Institutional Arrangements for International Environmental Cooperation. Report to the Department of State by the Committee for International Environmental Programs, Environmental Studies Board.

Ostrom, Vincent.
1971 Institutional Arrangements for Water Resource Development. National Water Commission (December).

Simon, H. A., D. W. Smithburg, and V. A. Thompson.
1950 Public Administration. New York: Alfred A. Knopf.

Chapter Seven
Some Problems of Institutional Analysis

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In exploring the relationship of "institutions" to urban water management with special reference to metropolitan areas, I propose to examine, first, some of the theoretical issues inherent in institutional analysis and, second, some practical issues which are raised in applying institutional analysis to problems of water resource management in metropolitan areas.

Decision Rules and Social Organization

I shall define an institution as a set of decision-making arrangements. I shall use "organization" as fully synonomous with "institution." That is, I would view the automobile industry as a set of decision-making arrangements and thus an institution or an organization, just as I would view General Motors or the Ford Motor Company as an institution or an organization, although the particular structure of decision-making arrangements in the automobile industry as a whole will differ from the decision-making arrangements in a specific firm such as General Motors or the Ford Motor Company; that is, where structural conditions vary we would expect patterns of conduct to vary. The critical issue in institutional analysis, then, is to specify relationships between conditions and consequences.

Institutional or organizational arrangements are a means of resolving a seeming paradox in human development. Human beings have capabilities for learning which give them access to very large bodies of knowledge. The accumulated pool of human knowledge in turn gives rise to an extraordinarily large repertoire of *potential variety* in human behavior. If all of the potential variety in human behavior were to be expressed in a random way, human beings would face a state of affairs approximating chaos.

In such a state of chaos, learning, which requires an understanding of regularities in events, could not occur. Learning is possible only to the extent that constraint is introduced into the total range of possibilities because constraint gives rise to regularities which can be observed and acted upon. Thus the paradox: humans need order or constraint in their environment as a necessary condition for learning, but learning itself increases the potential variety in human behavior which in turn threatens the maintenance of a predictable order in which continued learning can occur.

Decision Rules and Predictability

This paradox can be partly resolved by the introduction of a deliberate method of ordering relationships among people. Such ordering can be accomplished by instituting a common set of rules for decision-making ("decision rules"). Decision rules let people interact with each other under conditions which include some possibilities and exclude others. The *excluded* possibilities establish *constraints* or *limitations* upon decision-making capabilities. The *included* possibilities establish the *opportunities* or *capabilities* authorized in human conduct. Thus, decision rules establish the basis for social organization. *Reference to a common set of decision rules is a necessary condition for establishing ordered social relationships.*

If people use a common set of decision rules, individuals can pursue their interests in relation to one another in an orderly and predictable manner. Human behavior can be baffingly unpredictable to the behavioral scientist who tries to formulate universal generalizations without referring to decision rules. Human behavior can, by contrast, be surprisingly predictable to the scientist who refers to a common set of decision rules. An automobile driver, for example, who knows the common rules of the road, can arrive at his destination with a very high degree of predictability. *If*, lacking a common set of decision rules, *all automobile drivers were to act randomly*, the potential variety of behavior would preclude anyone from being able to reach his destination in an orderly and predictable manner.

Decision rules serve as guides for ordering human behavior. Thus we can speak of the rules of a game as "structuring" the play of a game. Decision rules connect the interests and opportunities of one person with the interests and opportunities of others. These connections are made by assigning decision-making capabilities which let each individual pursue his own interest while concurrently requiring him to take account of the interests of others. When viewed from this perspective, decision rules are used to "structure" social relationships and to "bias," "rig," or "determine" certain outcomes of any social situation.

Decision Rules and Social Welfare

The outcomes which derive from the structure imposed upon social relationships by a set of decision rules can be analyzed not only as to their predictability but also as to the degree to which they rig or bias human conduct to enhance or diminish human welfare. If each person pursued those opportunities which would increase his own welfare subject to the condition that he not diminish the welfare of others, and if this condition could be enforced with rigor, then we would expect the game of life to be "biased" or "rigged" in the direction of improving human welfare. If, on the other hand, each person were to "take what he could get and defend what he had got," we would infer that human

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* Some of the elements in this paper are more fully developed in Vincent Ostrom, Institutional Arrangements for Water Resource Development, Springfield, Virginia 22151: National Technical Information Service (Accession Number PB 207 314; $9.00), 1971, 596 pp. That study was prepared for the National Water Commission, whose support is gratefully acknowledged.

welfare would markedly decline. Decision rules can thus sustain predictability in human relationships and also order those relationships to induce either a favorable or unfavorable effect.

Enforcing Decision Rules

Since decision rules are neither self-generating nor self-enforcing, any pattern of social organization they establish must also refer to a set of decision-making arrangements which is concerned with determining, enforcing, and altering decision rules. It is on this basis that we distinguish governmental institutions from other institutions in any society. *Governmental institutions are those decision-making arrangements which are set up to determine whether conflicts exist, to enforce decisions, and to alter decision rules that affect patterns of social organization.*

Having recourse to decision-makers who have authority to determine, enforce, and alter legal relationships affecting the interests of others implies that any political association must be based upon an *unequal* assignment of decision-making capabilities as a *necessary* condition for the maintenance of decision-making capabilities. *Some* decision-makers *must* be able to make decisions which affect the interests of *others;* thus decision-making capabilities may be unequal.

Extraordinary authority or power to determine and enforce decisions in relation to others *necessarily requires the potential use of coercive sanctions* to support lawful behavior and to right wrongs resulting from unlawful behavior. Thus, patterns of political organization necessarily depend upon the potential exercise of coercive capabilities. Coercive capabilities involve the lawful exercise of unequal decision-making capabilities and have the consequence of leaving some persons worse off rather than better off, at least in the short run.

These conditions inherent in the logic of political choice leave us with a fundamental difficulty. On the one hand, an inequality of decision-making capability with its capacity to impose potential sanctions is necessary for sustaining ordered relationships among human beings. On the other hand, these conditions, though necessary, are clearly not sufficient to maintain orderly *and* productive relationships. The use of sanctions inherent in maintaining ordered social relationships may be a means to compound wrongs as well as to right them.

Where the structure of any given institutional arrangement depends upon the existence of other institutional arrangements capable of determining conflicts, enforcing decisions, and altering decision rules, structural interdependence among different decision-making arrangements is essential. Decision-making within a business firm will depend upon the competitive vitality of the market in any particular industry. Competition within market structures will similarly depend upon the existence of judicial, administrative, and legislative arrangements for maintaining and enforcing legal relationships among those who participate in market relationships. Decision-making among governmental agencies, in turn, will be affected by the degree of competitive rivalry among similar agencies, and the relative exposure of officials to electoral decisions, to popular referenda, to administrative review, to court actions, and to legislative surveillance.

The Problem of Institutional Failure and Reform

Ashby feels that social organization is based upon a presumption that no single form or organization is good for all circumstances (1962:255-278). A critical problem in institutional analysis is to determine the structural capabilities and limitations inherent in different types of institutional arrangements and to predict the consequences which follow when those limits are exceeded. An initial effort can be made by pointing out some of the conditions of institutional weakness or failure which are characteristic of the different forms of organization relevant to the conduct of human enterprises. To determine some of the sources of institutional deficiencies I shall examine, first, the conclusions reached by economists regarding market weakness and market failure, then those of political scientists regarding the shortcomings in American public administration. Many of the findings of American political scientists with respect to organizational pathologies are now being challenged by contemporary scholars in economics, political science, and sociology, who have identified other serious problems of institutional weakness and institutional failure in large-scale public bureaucracies. We are left with the question of what form of analysis to apply to problems of water resource management in urban areas.

Sources of Market Weakness and Market Failure

In economic theory, market organization assumes that individuals are free to enter into transactions to buy and sell goods and services. Each individual is presumed to be a rational, self-interested person who attempts to maximize his net economic advantage. Buyers and sellers will compete with each other. Where numerous competitors exist among both buyers and sellers in any commodity market, the competitive force of the market will, in the long run, establish an equilibrium where supply equals demand at a price which will clear the market. If all commodity markets were perfectly competitive, price would establish an equivalence so that a dollar's value for one commodity would be equal to a dollar's value for another commodity.

These conditions can prevail where the goods and services subject to economic transactions are highly separable and homogeneous. Such goods and services can be packaged, contained, and measured in discrete units and can be exchanged under circumstances where the potential buyer can be excluded from enjoying the benefit unless he is willing to pay the price. Such commodities should also meet the condition that their consumption is exclusive so that any one person's consumption fully excludes anyone else from enjoying the good. Goods which are fully separable and are subject to exclusion in *possession,* in *exchange,* and in *consumption* can be defined as purely private goods. But "events," which are viewed as "goods" in the sense that people demand them, begin to depart from conditions of separability and exclusivity in possession, exchange and use, the market begins to show signs of institutional weakness. Economists have broadly characterized three types of events which depart significantly from the characteristics of a purely private good: externalities, common-pool/flow resources, and public goods. Problems of institutional failure in market arrangement increase as one moves from externalities to public goods. Market arrangements must inevitably fail to sustain the provision of a purely public good.

Externalities. Buchanan and Stubblebine have defined "externality" as an effect associated with an economic good which, because it cannot be readily contained by those involved in a transaction, spills over upon others in the neighborhood (1962:371-384).* The effects of positive externalities are beneficial to the neighborhood; those of negative externalities are detrimental. Some attributes of an economic good may be highly separable and thus have the characteristics of a private good. Most uses of water will, for example, generate negative externalities, as the quality of water is likely to diminish after each use. Such externalities become problems as they assume significance in the interpersonal economy of a community. The problems posed in any effort to control externalities are similar to those involved in events having the attributes of common-pool/flow resources and public goods.

Common-Pool/Flow Resources. A common-pool/flow resource is some set of events where several individuals may make a separate and individual consumptive use of the resource, while the supply of the resource is indivisible and is shared in common (Ostrom, 1968:123-150). The use or consumption by one may impair its use or consumption by another even though the several users cannot exercise exclusive possession over the supply of the resource. In the event that a common-pool/flow resource is a replenishable or renewable one, no serious problems of interdependency may be generated until the demands upon the resource begin to exceed the sustainable supply.

Where demands exceed the supply of a common-pool/flow resource, serious problems are engendered because though each person's use will exclude the use by others, no one user can effectively control other users. Competitive rivalry in the use of a common-pool/flow resource where demand exceeds supplies will cause the situation to deteriorate, since every increase in demand will leave the aggregate community of users worse off. Thus, the failure of the exclusion principle to operate in the possession of a common-pool/flow resource implies that such a resource must be treated as a common property subject to individual use by many different users, each having separable interests in that common property. The separability of use implies that a partial interest may be identified as the basis for a private property. The partitioning of property rights to a common-pool/flow resource always poses difficulties in dealing with the interdependencies and indivisibilities of supply as against divisibility in demands and uses. The wide range of joint and alternative uses characteristic of many water resource systems generates substantial impediments to the use of market arrangements for allocating these different goods and services. The lack of an exclusion principle applicable to the possession of water at its source, together with the existence of elements of exclusion in the consumption of water supplies, implies that non-market arrangements may be necessary for dealing with many of the common-pool aspects of a water-supply system, while market arrangements can be utilized in the distribution and sale of some water services.

An intermediate situation exists where the water supply may be a common-pool resource which is not directly consumed in its natural state but is subject to an intermediate production process involving storage, diversion, transmission, and distribution. The commodity may then be confined and metered for sale but is *not* subject to distribution by competing vendors. In such circumstances, water services can be marketed, but the regulatory effect of market competition does not prevail. The potential power of a monopoly water supplier over water consumers would be expected to generate substantial elements of market weakness.

Public Goods. Public goods are similar to the common-pool/flow resources, but with the important distinction that the ultimate user or consumer cannot be excluded from enjoying the benefit made available to any other consumer (Samuelson, 1955:350-356).* The indivisibilities are such that many persons can relate themselves to a particular set of events, and consumption, use, or enjoyment by one does not exclude consumption, use, or enjoyment by others. An effort to provide a public good for some implies that such a good will necessarily be made available for all who may live within the domain of that set of events, since no one can be excluded from enjoying the benefits which are made available to some.

The various uses of water range over the spectrum of the above distinctions. The criteria associated with a purely private good are met in the relatively trivial case of bottled water. Most uses of water involve significant externalities. The common-pool/flow resource characteristic of most water supply systems implies that common-property relationships permeate the field of water-resource development. Flood-control measures come close to approximating the condition of a purely public good when viewed as a means of reducing a natural threat or hazard to individual welfare. Each person within a flood plain will benefit without excluding others from benefiting, also, up to some limit of the regulative capacity of the flood-control system. The "good" in this case is a reduction in the cost of a potential "bad."

Since water-resource developments are largely confined to the circumstance involving either significant externalities, common-pool/flow resources, or public goods, reliance upon the individualistic type of choice characteristic of market arrangements where producing and allocating water are concerned will generate serious problems of institutional weakness and institutional failure. The characteristic patterns of such institutional failure will be considered in the following section.

Individualistic Choice and the Tragedy of the Commons

Where a community of individuals is concerned with a common-pool/flow resource or a public good, if we assume that each person is free to decide for himself to pursue his individual interest, some serious problems follow as a logical consequence (Hirshleifer, DeHaven and Milliman, 1960). Each individual will expect to maximize his own net welfare by taking advantage of the common property or public good at minimum cost to himself. When the aggregate demand of all individual users exceeds the available supply, an increase in demand by each user, an increase in the number of users, or both, will involve an increasing cost in impaired supply for other users in addition to the

* See also R. H. Coase, "The Problem of Social Cost," Journal of Law and Economics 3 (October, 1960), 1-44.

* See also Paul A. Samuelson, "The Pure Theory of Public Expenditure," Review of Economics and Statistics 36 (November, 1954), 387-389.

individual cost that each person bears in making his own use. However, each person will calculate only his individual cost and will ignore the social costs imposed upon others. He will choose a "dog-in-the-manger" strategy, pursuing his own advantage and disregarding the consequences of his actions for others. Furthermore, some individuals will be motivated to conceal information about their intentions so that, should others propose any form of joint action, they might then remain free to take advantage of any opportunities created by those joint actions. If voluntary actions are taken to curtail demand, some individuals will pursue a "hold-out" strategy, and the hold-outs will be free to capture a lion's share of the benefits derived from the voluntary joint actions of their neighbors. As long as each person is free to decide his own course of action, the probability of someone's pursuing a hold-out strategy is high, and the presence of hold-outs will threaten the stability of any joint voluntary solution.

If this competitive dynamic is allowed to run its course, social costs will escalate to a point where the potential economic surplus to be derived from optimal use of a common-pool/flow resource will have been eliminated by excessive investment in individual efforts, perhaps even to the point where operations are sustained without economic advantage to the community of users. Individuals in weaker economic positions will be forced out, and the neighborhood effect will be to generate poverty, deprivation, threats, and even violence.

This eventuality has been characterized by Garret Hardin as "the tragedy of the commons" (1968:1243-1248). Individualistic decision-making applied to common-pool/flow resources will inevitably result in tragedy unless the structure of decision-making arrangements can be modified to enable persons to act jointly in relation to those resources as a common property. The potential to take coercive measures will also be necessary to preclude a hold-out strategy and to regulate patterns of use among all users. Unrestricted individualistic decision-making in relation to common-pool/flow resources or public goods will lead to the competitive dynamic of a negative-sum game: the greater the individual effort, the worse off people become.

The problem arising from the indivisibility of a public good and the structure of individual incentives created by the failure of an exclusion principle is the basic problem examined in Mancur Olson's *Logic of Collective Action* (1965). Olson concludes that individuals cannot be expected to form large voluntary associations to pursue matters of common or public interest unless special conditions can be met. These conditions will exist only when members can derive a separable benefit of a sufficient magnitude to cover the cost of membership from the action or when they can be coerced into bearing their share of the costs. Thus, we cannot expect people to organize themselves voluntarily to manage a common-pool/flow resource or secure the provision of a public good. Even the articulation of public demands to undertake governmental action can suffer from what might better be called the logic of collective *inaction* under conditions of individualistic decision-making.

In summary, then, when individuals act with the legal independence characteristic of decision-making in market structures where the structure of events has the attributes of externalities, common-pool/flow resources, or public goods, we can conclude that institutional weaknesses or institutional failures will occur, and that the magnitude of the shortcomings will depend upon the importance of the externality or upon the degree of indivisibility occurring in the common-pool/flow resource or public-good situation.

The Diagnosis of Organizational Pathologies in American Public Administration

The problems of market weakness and market failure associated with externalities, common-pool/flow resource, or public-goods situations imply that some form of public control and public decision-making is necessary to deal with these events. However, American preoccupation with problems of political reform and administrative reorganization in the public sector clearly suggests the presence of institutional shortcomings there. Recourse to non-market arrangements to procure the provision of a variety of public goods and services may be a necessary condition for advancing human welfare, but reliance upon governmental organization may, in turn, engender conditions of institutional weakness and institutional failure. These conditions need to be considered in conceptualizing the appropriateness of public organizational arrangements for the provision of goods and services where market conditions fail to provide satisfactory solutions.

Beginning in the late nineteenth century and early twentieth century, American political scientists developed a form of institutional analysis which attempted to diagnose the pathological conditions that gave rise to serious shortcomings among public organizations. A series of reforms was prescribed to correct those deficiences.

The initial concern of these political scientists was with the gross patterns of political corruption which had occurred in the post-Civil War period when American social and economic life was undergoing radical transformations. Competitive rivalry among many different units of government often gave the appearance of generating a tragedy of the commons when problems of public policy arose. Efforts to initiate reform measures in one state could be frustrated by the propensity of large-scale business enterprises to shift their favors to states less sympathetic to reform. Thus the states which made no efforts at reform functioned as hold-outs to negate the efforts of some states to regulate social problems of concern to people in many states.

The dynamics inherent in the tragedy of the commons, indeed, do apply to rivalry among units of government when they confront interdependencies which are intergovernmental in scope. The United States Constitution was formulated as a means of avoiding such a competitive rivalry among the various American states over problems of collective security, interstate commerce, and related matters. The availability of a national government capable of regulating public affairs where they impinged upon interstate relationships provided alternative institutional arrangements for problems of rivalry among the states.

The multiplicity of governmental units in the American system of government and the constitutional separation of powers which divided authority among different branches of government were viewed by political scientists as contributing to other elements of institutional weakness. The long ballot created by the large number of public officials elected in the different jurisdictions was said to overburden American voters. The overburdened voter, according to these

analysts, was unable to discriminate among candidates for public office and relied instead upon party slates. Political parties thus became an instrument to overcome the fragmentation of authority among the separate decision structures and the different units of government. The active direction of government was assumed by party bosses who controlled affairs behind the facade of numerous offices, decision structures, and units of government. Reformers holding this point of view argued that the political responsibility of elected officials could be increased only by (1) drastically reducing the number of officials who were popularly elected and (2) developing a responsible party system where the party winning the support of the majority of the electorate -- not individually elected office holders -- could assume authority for the conduct of government without being frustrated by a system of checks and balances.*

Public administration was viewed as being outside the proper realm of politics. Politics, the political scientists of the time felt, was concerned with the formulation of public policy, while administration was concerned with its execution. Once policies were set, the task of administration was a matter calling for professional expertise in the technical details of government.

Principles of good administration will, from this point of view, be much the same in any system of government. Woodrow Wilson, as a scholar contributing to this form of analysis, contended that there is "but one rule of good administration for all governments alike." He says further: "So far as administrative functions are concerned, all governments have a strong structural likeness; more than that, if they are to be unifirmly useful and efficient, they *must* have a strong structural likeness" (1887:218).

"Good" administration for Wilson would be hierarchically ordered in a system of graded ranks subject to political direction by heads of departments at the center of government. The ranks of administration would be filled by a corps of technically trained civil servants "prepared by a special schooling and drilled after appointment, into a perfected organization, with an appropriate hierarchy and characteristic discipline. . ." (1887:216). Perfection in administrative organization, Wilson feels, is attained in a hierarchically ordered and professionally trained public service. Similarly, efficiency is attained by perfection in the hierarchical ordering of a professionally trained public service. Wilson also conceptualizes efficiency in economic terms: ". . . the utmost possible efficiency and at the least possible cost of either money or of energy" (1887:197).

Hierarchical organization was thought to provide a set of universal principles which could be applied to any administrative situation. Leonard White, for example, asserted that:

> All large-scale organizations follow the same pattern, which in essence consists in the universal application of the superior-subordinate relationship through a number of levels of responsibility reaching from the top to the bottom of the structure (1926:33).

In this type of organization, coordination is enhanced by the centering of ultimate administrative responsibility in a single chief executive who exercises a unified command over all administrative agencies. Since any one person can exercise effective supervision over only a small number of subordinates, the structure of authority within a system of administration is organized through progressively smaller units of organization, each headed by a single person subject to direction by superior authorities, eventually culminating in the unified command of a chief executive. A variety of staff and management functions are organized in the chief executive offices to assist in the exercise of management control over all subordinate agencies.

Over the past several decades, thousands of administrative surveys and reorganization proposals have been made based upon the theoretical presuppositions and principles of organization inherent in the traditional public administration approach. The standard format of these surveys is a diagnostic assessment of the organizational pathologies which are associated with a proliferation of agencies, fragmentation of authority, overlapping of jurisdictions, and duplication of services. The Brownlow Commission, the various Hoover Commissions, and the current Ash Council are among the more prominent examples of such reorganization surveys. Duplications of services and overlapping jurisdictions are presumed on *prima facie* grounds to be wasteful and inefficient and therefore are to be eliminated.

Remedial action based upon this diagnostic assessment of organizational pathologies is sought in reforms which have the effect of eliminating the proliferation of agencies, the fragmentation of authority, the overlapping jurisdictions, and the duplication of functions. Large jurisdictions are preferred to small. General-authority agencies are preferred to limited-authority agencies. Centralized authority is preferred to the decentralization of authority among diverse decision structures.

Problems of Dysfunctional Behavior in Large-Scale Public Bureaucracies

The institutional analysis practiced by American students of public administration and by administrative consultants paid little or no attention to problems of institutional weakness or institutional failure of public bureaucracies. The principle of span of control implied a rather substantial limit upon the capability of any one supervisor to exercise control over a number of subordinates. The more routine and uniform the tasks, the larger the number of workers any one supervisor might control. The numbers were, in any event, assumed to be small (the figures usually cited were in a magnitude of less than ten).

In the traditional theory of public administration, the question of limit on size implied by the principle of span of control was resolved by extending vertically the number of tiers in an administrative hierarchy. Limits upon the ability of any one person to coordinate and supervise a small number of subordinates, it was felt, could thus be overcome.

This problem was given critical attention by Herbert Simon when he pointed out that a loss of information and control would apply as well to the number of tiers in a hierarchical structure as to the number of subordinates reporting to any one superior (1964). Thus, increasing the number of tiers in a hierarchy would lead to a loss of information and control between the top level of command and those at the lower working levels, while narrowing the command structure

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* See, for example, Richard S. Childs, Civic Victories, New York: Harper and Brothers, 1952.

at each level of organization would likewise lead to a loss of information and control by increasing the number of levels in an organization. Simon's discussion suggests serious limits to the aggregate size of bureaucratic organization.

R. H. Coase, in an article on "The Nature of the Firm," conceptualizes some of the factors which are relevant to determining the optimum size of a bureaucratic organization (1937:386-485). According to Coase, rational individuals might be expected to organize a firm on hierarchical principles where management responsibilities would be assumed by an entrepreneur and where others would be willing to become employees if the firm could conduct business under direction of the entrepreneur at a lesser cost than if each and every transaction were to be organized as a market transaction. The firm would be organized on the basis of long-term employment contracts rather than short-term risks in employment while the entrepreneur could take advantage of reduced decision-making costs in allocating his work force so as to optimize net return, at the cost of limiting entrepreneurial discretion. With that constraint upon the entrepreneur, the employee agrees to obey his instructions. Such an entrepreneur is exposed, in the conduct of his enterprise, both to market competition and to the necessity of long-term satisfaction of employees.

Coase's theory of the firm explains why a business firm would institute managerial control in the organization of an enterprise in order to reduce decision costs, that result from time and effort expended and opportunities foregone, which would otherwise be incurred by negotiating market transactions so as to aggregate the elements of production. Coase anticipates limits to the size of firms if the costs of using a factor of production purchased in the market would be less than adding a new component to the firm to produce that added factor of production, since as more employees were added, management costs would be expected to increase. A point would be reached where the saving on the marginal employee in decision costs would not exceed the added management costs required to supervise that employee, and thus no net savings would accrue to the entrepreneur. Also, if a firm became too large, an entrepreneur might fail to see some of his opportunities in the allocation of his work force. Another entrepreneur with a smaller, more efficient firm would thus have a competitive advantage over the larger firm which had exceeded the limits of scale economy in firm size.

Coase's analysis gives us reason to believe that bureaucratic organization can be a means of enhancing efficiency in operations by minimizing decision costs within the limits provided by the employment contract and the competitive force of the product market. But the competitive force of a product market is absent in most public organizations. As a consequence, public organizations are apt to be less sensitive to the diseconomies in scale which accrue from increasing management costs. Under those circumstances, the increased costs of management might exceed the savings in decision costs and generate a net loss. In that case, increased centralization in public decision-making and continued reliance upon the principles of hierarchical organization in the public sector will lead to increasing inefficiencies as management costs exceed the benefits derived from each added employee.

Gordon Tullock, in *The Politics of Bureaucracy*, pursues an analysis of the consequences which can be expected to follow when rational, self-interested individuals pursue maximizing strategies in the context of very large public bureaucracies (1965). Tullock's "economic man" is an ambitious public employee who seeks to advance his opportunities for promotions within the bureaucracy. Since career advancement depends upon favorable recommendations by his superiors, a career-oriented public servant will act so as to please his superiors. Favorable information will be forwarded; unfavorable information will be suppressed. Such distortion of information will diminish control and generate expectations which diverge from events sustained by actions. Large-scale bureaucracies will thus become error-prone and cumbersome and have trouble adapting to rapidly changing conditions. Efforts to correct the malfunctioning of bureaucracies by tightening control will simply magnify errors by leading to further repression of information. A decline in return to scale can be expected to result. The larger the organization becomes, the smaller will be the percent of its activities directly related to output, the larger the proportion of its efforts expended on management, the larger the degree of misinformation, and the greater the disparity between organizational goals and organizational perfor ance.

Tullock suggests that the limits upon control in the very large public bureaucracy will engender a "bureaucratic free enterprise" where units or groups within an organization proceed to formulate their own missions without reference to policy objectives or organizational goals. Goal displacement, risk avoidance, and inaction motivated by individual self-interest will be covered up by elaborate justification through misleading information. Bureaucratic free enterprise may also take a form where public employees extract a bribe as a price for public services. The social consequences engendered by the discrepancies between bureaucratic action and the public rhetoric of political leaders become increasingly contradictory, even "unreal," to an independent observer. Michel Crozier extends this type of analysis to sustain the conclusion, in his study of French bureaucracy, that ". . . *a bureaucratic organization is an organization that cannot correct its behavior by learning from its errors*" (1964:187).

The absence of a competitive product market in a public-service economy will engender other sources of institutional weaknesses in large-scale public bureaucracies which arise from disparities between producer interests and user interests. Once a public good is provided, the absence of an exclusion principle means that each individual will have no choice but to take advantage of whatever is provided, unless he is either able to move to another jurisdiction or is wealthy enough to make separate provision for himself. Under these conditions, the producer of a public good may be relatively free to induce savings in production costs by increasing the cost to the user or consumer of public goods and services. Shifts of producer costs to consumers may result in an aggregate loss of efficiency if savings on the production side are exceeded by added costs on the consumption side. Public agencies rarely, if ever, calculate the value of a user's time or his inconvenience when they engage in studies of how to make better use of their employees' time. If a citizen has no place else to go, and if he is one of a million other citizens, the probability of his interest being taken into account is negligible. And it is the most impoverished members of a community who are most exposed to deprivations under these circumstances. From this theoretical perspective, an analyst would not be surprised to find public water agencies supplying water to large industrial users at substantially lower rates than to individual householders.

The inability of users of public goods and services to sustain an arm's-length relationship with producers of public goods and services generates further problems when user preferences are subject to change in relation to the available supply of public goods and services. No one can know the preferences or values of other persons without giving those persons an opportunity to express their preferences or values. If constituencies and collectivities are organized in a way that does not reflect the diversity of interests among different communities of people, then producers of public goods and services will take action without information as to the changing preferences of the persons they serve, making expenditures with little reference to consumer utility. *Producer efficiency in the absence of consumer utility is without economic meaning.*

Similar difficulties may occur when demands for a public good or service having the characteristics of a common-property resource increase in relation to the available supply. When demands begin to exceed supply, the dynamics inherent in "the tragedy of the commons" may take place all over again. For instance, an increasing pollution load may drive out those who would make other uses of a watercourse. What was once a public "good" may now become a public "bad" as pollution precludes a growing number of opportunities for other uses. In short, public services may be subject to serious *erosion* or *degradation* under conditions of changing demands (Buchanan, 1970). In the absence of the ability to respond with modified supply schedules and regulations for use, a public "good" may come to be a public "bad" and "the tragedy of the commons" may reach critical proportions.

Finally, producer performance and consumer interests are closely tied together when we recognize that the capacity to levy taxes, to make appropriate expenditure decisions, and to provide the necessary public facilities is *insufficient* for the optimum use of such facilities, since one pattern of use may impair the value of a common facility or a public good for another pattern of use. Developing water-resource facilities will not be sufficient to enhance the welfare of members of a community of users unless attention is also paid to basic rules and regulations controlling the use of such facilities by different sets of users. Use of project facilities for recreational purposes, for example, may impair their use for domestic and municipal water services. One man's recreation may be another man's terror.

Optimal use of public facilities, when each use is not fully compatible with each other use, requires a system of rules and regulations setting limitations upon the discretion which users can exercise with respect to common facilities. The development of such rules and regulations are relevant both to the scheduling of production processes and to the ordering of use patterns by potential users or consumers. These rules and regulations, like any set of decision rules, are *neither self-generating, self-modifying, nor self-enforcing*. Thus, we are confronted with the basic problems of who shall enact and who shall enforce rules of conduct to govern relations among individuals who use common properties or public facilities. Administrative rules and regulations are not a matter of political indifference to the users of such goods and services.

Bureaucratic organization, then, while it will contribute significant institutional capabilities in the organization of any enterprise or agency concerned with the control of externalities, the management of a common-property resource, or the provision of a public good, will also be subject to serious institutional shortcomings. An optimal scale of public enterprise needs to take account of diversity in demands, of production economies, of the relationship of demand to conditions of supply, and of relationships where one pattern of use may impair other patterns of use. The very large bureaucracy will (1) become increasingly indiscriminate in its response to diverse demands, (2) impose increasingly high social costs upon those who are presumed to be the beneficiaries, (3) fail to proportion supply to demand, (4) allow the use of public facilities to erode by failing to take action to prevent one use from dominating other uses, (5) become increasingly error-prone and uncontrollable to the point where public actions deviate radically from public rhetoric about organizational goals, and (6) eventually lead to a situation where remedial actions exacerbate rather than ameliorate problems. The circumstances which generate organizational dysfunctions in large-scale bureaucracies pose problems which require serious reconsideration of the theory of organizational arrangements applicable to public administration.

Institutional Arrangements for Water Resource Management in Metropolitan Regions

The administrative analysts associated with the traditional public-administration approach and the contemporary political economists have made different diagnoses of the conditions which generate institutional weakness and institutional failure within and among public organizational arrangements. The administrative analysts identify overlapping jurisdictions and fragmentation of authority as the major source of institutional failure in the public sector and prescribe the integration of political structures into a single unit with an integrated chain of command coordinated through a single chief executive.

The political economists find the most serious sources of institutional weakness and institutional failure in the large scale of public bureaucracies. They suggest that a political economy concerned with the provision of a large variety of different public goods and services can best be organized through a diversity of public enterprises, the jurisdiction of each enterprise taking account of the territorial domain associated with some particular field of effects which may be identified as an externality, a common property resource, or a public good. The individuals who are affected by the particular field of effects can be conceptualized as an inchoate public. If some common measure can be taken on behalf of that inchoate public which would improve its welfare, then consideration might be given to organizing it into a political community which could undertake a collective enterprise. Problems of conflict among public enterprises can be resolved either by deliberately building in elements of overlap which will take account of new levels of interdependency or by having recourse to the services provided by some existing unit of government where its boundaries supply an approximate fit for the interdependencies involved.

These political economists would view overlapping jurisdictions as providing an opportunity to procure diverse public goods and services implicating many different communities of interest. A federal system of government necessarily implies overlapping jurisdictions. Such overlap creates opportunities for democratic controls, legislative controls, and judicial controls to be operative in the governance of public enterprises. Reliance upon democratic controls (as expressed through elections), legislative controls,

and judicial controls permits the relaxation of hierarchical controls so that patterns of democratic administration can be substituted for bureaucratic administration. In addition, bargaining and constrained competitive rivalry among diverse agencies with overlapping jurisdictions permits quasi-market mechanisms to develop among public enterprises. These quasi-market mechanisms generate a regulatory tendency analogous to the "hidden" or "indivisible" hand operating in a competitive market economy.

A multiplicity of public enterprises within a structure of overlapping jurisdictions will, thus, tend to take on the characteristics of a public-service industry. Some enterprises will operate as retailers, others as wholesalers, and still others as large-scale producers.

These different perspectives provide two possible, but basically different, models of organization for water resource management in metropolitan areas. The administrative analysts consistently recommend a fully integrated regional management structure. The political economists would prefer a structure much like that of an industry, and they would anticipate that a fully integrated monopoly would be less likely to attain an efficient allocation of resources than a multi-firm industry subject to constrained rivalry.

The Fully Integrated Regional Management Approach

The fully integrated regional management structure usually assumes the creation of a regional agency able to internalize all lesser communities of interest within a single metropolitan region.* That agency would be governed by a representative legislative body capable of defining the public interest of the larger metropolitan community and of deciding what public measures to take in realizing the broader public interest. The execution of those measures would be subject to the direction of a single chief executive who could rely upon an integrated command structure to assure overall coordination.

Applying this type of organizational formula leaves two problems unresolved. The first is the formulation of an appropriate set of boundaries. The second is the inclusion of an appropriate range of functions or services.

The areas of urban communities aggregated into metropolitan areas and water supply systems rarely coincide. Drawing the boundaries of a metropolitan region is in itself a difficult exercise. Where, from Boston to Washington, D. C., can the boundaries of different metropolitan areas be distinguished? Why stop with Boston and Washington? Then, how ought these boundaries be interrelated with the Connecticut, Hudson, Delaware, Susquehanna, Potomac, and other watersheds? Is it necessary to subsume an eleven-state area to bound a metropolitan water-management region for the urbanized region of the Atlantic seaboard?

From the point of view of traditional public administration theory, problems of water resource management would not be separated from other public service functions in any particular metropolitan region. The critical intersection of interests between water supply and land use, transportation, recreation, sanitation and waste removal, public health, quality of the environment, and energy supply would imply that all of these functions should be subsumed within a common organizational structure accountable to the direction of a single chief executive. On this theory, a multi-functional water management agency could not be justified apart from a multi-functional unit of government having general jurisdiction over all internal problems.

If a fully integrated water-management structure were to be established for the urbanized region of the Atlantic seaboard, could we make any predictions about the consequences which are likely to follow from such an organizational structure? On the basis of the earlier discussion of dysfunctional behavior in large-scale public bureaucracies we would expect the following consequences to occur:

1. *Loss of Voice.* As decision-making is centralized in larger units of government to the exclusion of lesser jurisdictions, the ratio of individual constituents to elected representatives is altered so that each voter has less voice in the decision being taken and representatives have less information about the changing preferences of their constituents. The more fully integrated the governmental structure, the larger the number of public services it will produce and the less information central decision-makers will have about the appropriate mix of public goods and services to be provided.

2. *Inability to Proportion Supply to Demand.* Such decline in information about user preferences implies that central decision-makers will be increasingly unable to modify supply conditions to meet changing demands for public goods and services. The less voice given to constituents to express and enforce their demands, the more public bureaucracies will be inclined to produce an abundance of goods for which there is little demand or fail to produce other services for which there is substantial demand.

3. *Overloading of Central Decision-Makers.* Where decision-making is highly centralized in a single center of authority subject to a unitary command structure, those at the center of authority are subject to the limitation that only one person can speak and be heard by a single audience at any one time. Decision-making is always conducted under extreme constraint. When central decision-makers become overloaded, time must be rationed and problems must be ordered into the single-file sequence of an agenda. Such decision-makers may act with a high degree of dispatch in dealing with some problems, but other problems may never reach priority as the first order of business. Under those circumstances some problems are resolved, but others are disregarded.

4. *Loss of Adaptive Capability in Proportioning Responses to Diverse Environmental Conditions.* Environmental conditions, especially those relevant to water-resource development, are subject to large measures of variability resulting from many different communities of interest. A presumption that there can be a *regional* response to *regional* needs through a more rational balance of planning and managing resources at the *regional* level will diminish rather than enhance the range of developmental opportunities. Adaptive behavior requires a capacity to select responses which are appropriate to variability in the environment.

5. *Loss of Control.* The loss of information in

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* See, for example, Urban Systems and Engineering, Inc., Metropolitan Water Management: Case Studies and National Policy Implications, Springfield, Virginia: National Technical Information Service, 1971.

large-scale, public bureaucracies is accompanied by a comparable loss of control. In turn, the loss of control is often accompanied by increased expenditures upon "management" in an effort to regain control. The net effect is increased inefficiency and compounded difficulties in "managing" the management controllers. The loss-of-control factor may become manifest in circumstances where units in a bureaucracy proceed with operations that are counterproductive for other units in the same organization. In extreme cases, the loss of control may degenerate into gross administrative and political corruption.

6. *The Development of a Public Rhetoric Not Meaningfully Related to Tangible Problems.* Loss of information, the overloading of central decision-makers, and loss of control may contribute to a situation where central decision-makers, who depend upon mass audiences for periodic election, have recourse to slogans and glittering generalities in formulating regional policies which are not meaningfully related to the solution of tangible problems. Such solutions, implied by slogans asserted with presumptions of omniscience and omnicompetence, may compound errors, making matters worse rather than better.

The potential costs suggested above may far outweigh the benefits which might be derived from the reorganization proposals advanced by administrative analysts. Such reorganization proposals have been made repeatedly over the past several decades with only limited success. Wherever the electorate has had an opportunity to approve or reject comprehensive reorganization proposals advanced by administrative analysts, most of them have been rejected. Such actions are consistent with an assumption that citizens place substantial priority upon opportunities to express their voice in the conduct of public affairs.

If this is true, a reasonable measure of doubt may exist about the hierarchical organization as the exclusive method for resolving conflict and interagency rivalry among water-resource agencies. Relying upon one multifunctional regional agency to provide all water services and to control all patterns of water resource development within a metropolitan region is a solution which can be expected to generate greater costs than benefits. Similarly, the aggregation of all land, water, energy, transportation, recreation, health, and other agencies into one regional jurisdiction on the assumption that most conflicts over resource development can be settled within the confines of an administrative bureaucracy will also generate high costs in the types of institutional weaknesses and institutional failures which are associated with large-scale public bureaucracies.

The Public-Service-Industry Approach

Political economists, by contrast, assume that conditions involving externalities, common-pool/flow resources, and public goods in water-resource development may involve a very large number of potential public goods and services. Provision of these goods and services will, in many instances, require recourse to public or collective enterprises where the power of taxation is necessary. In other cases, private organization may be a feasible alternative. The provision of many forms of water service, for example, is feasible by either private or public organizations. The choice of particular arrangements will depend upon the relative advantages to be derived from alternative forms of organizational arrangements. Economic advantage can accrue only if an *appropriate* form of organization is used.

If a valid theory of constitutional choice is available, political economists would conclude, a community of water users might devise different forms of public or collective enterprises with appropriate sets of decision rules to enhance their economic welfare and sustain an equitable distribution of costs in relation to the benefits to be realized. If such conditions can be met, any one public enterprise would be able to internalize the relevant costs and benefits of providing water as a public service and operate with substantial autonomy. Where externalities exist in relation to several such enterprises, recourse to various political decision structures will provide opportunities for searching out solutions to those conflicts of interest.

If the number of potential public goods and services involves radically different scales of effects and communities of interest, a number of different public enterprises can be organized in relation to different levels of government. In such a case, the existence of overlapping jurisdictions and fragmented authority is viewed as creating an opportunity to organize different public enterprises so as to be able to take advantage of diverse economies of scale. Mancur Olson, for example, has observed:

> Only if there are several levels of government, and a large number of governments, can immense disparities between the boundaries of collective goods be avoided. There is a case for every type of institution from the international organization to the smallest local government. It is the merit of the present approach that it can explain the need for both centralized and decentralized units of government in the same context (1965:483).

This conclusion is the antithesis of that proposed in the classical theory of public administration. These political economists perceive that instead of chaos and disorder arising from overlapping jurisdictions and fragmented authority, patterns of ordered relationships can be sustained among diverse public enterprises. In their view, the variety of enterprises providing water services in different metropolitan regions can have the characteristics of public service industries where competitive rivalry can enhance rather than diminish social welfare *if* such rivalry is appropriately bounded by alternative institutional arrangements for the resolution of conflicts.

Political economists would not be surprised to find that a "tangled system" of public organizations with overlapping jurisdictions "seems to operate reasonably well" (Urban Systems, 1971:V). Indeed, they would expect public-service industries or public-enterprise systems which allow for independence in the pursuit of developmental opportunities to be a highly productive system for advancing the economic welfare of people sharing many diverse communities of interest. They would expect a regional water industry with its interagency rivalry to be highly productive in its output of water services. If the interagency rivalry were eliminated, then political economists would predict a marked decline in the level of productivity.

Thus, political economists would conclude that the peculiar structure of regional water industries is a source of strength rather than a source of weakness. Significant shortcomings in the sense of institutional weakness or institutional failure are evident in the American water industry, but such shortcomings do not

require alterations in the basic structure of the industry.

The most serious shortcoming in the performance of the American water industry from the perspective of a political economist is an overinvestment in water-resource facilities -- an overdevelopment of water for some uses and a correlative underdevelopment of other water services. Patterns of overinvestment are indicated where public funds have been used to construct water works, and to provide water, at less than cost. Large quantities of water are used to support marginal economic activities where the rate of return is not justified by the level of public expenditure.

This analysis leads to the conclusion that greater rather than less independence among public agencies operating within a water industry would improve its efficiency in performance. A major shortcoming in the structure of the water industry is the failure of fish, wildlife, and recreational agencies and waste-treatment agencies to exercise sufficient entrepreneurial initiative to realize the opportunities which can be derived from those resource potentials. Freeing those agencies from the grosser constraints inherent in the doctrine of sovereign prerogative and extending their public corporate authority to exercise greater proprietary independence in the development of fish, wildlife, and recreational opportunities and in the reclamation of waste waters as publicly provided goods and services might be encouraged. Greater proprietary independence should be accompanied by a concern for an appropriately structured decision-making arrangement which will provide for representation of the relevant constituent communities in the organization of these agencies as public enterprises. Such enterprises, if appropriately constituted, could be encouraged to derive greater revenues from license fees and service charges to cover the costs of the services being provided.

If the supply of water in any given area is insufficient to meet all demands, then a substantial presumption exists that any new development will be at the cost of some alternative patterns of use. A failure to charge a price for that water which *fully* covers the value of foregone opportunities means that water is being taken *from* some users to provide benefits *for* other water users. Under these circumstances, economic rationality would suggest that a price be charged for water at its source and that investments in water-resource development be repaid in full from charges levied against those who benefit.

A variety of different methods might be used to price water at its source. One method would be to introduce use taxes, or severance taxes, which would impose charges upon any water user in proportion to the amount of water used. This principle has been used in the development of "pump taxes" to finance the operation of ground-water replenishment and management programs in California. Use taxes need not be limited to water pumped from ground water supplies but can apply to water diverted for irrigation; for domestic, municipal or industrial purposes; for the generation of hydro-electric power; to the licensing of sports fishermen; to the catch of commercial fishermen; to the transport of commodities through inland waterways; to the development of insurance against flood risks; or for the discharge of sewerage effluent.

Use taxes are at best only crude pricing mechanisms, but they at least create incentives for water developers and water users to take account of relevant costs. Current practices of licensing projects without charging for the value of water at its source or of expending funds from the public treasury to construct water works create incentives to ignore the relevant costs or to engage in strategies to raid the public treasury. Use charges as crude pricing mechanisms can help increase, rather than decrease, economic efficiency.

If policies were established (1) to require full reimbursability for all costs of water-resource developments, (2) to apply use taxes or some alternative method to charge for the full value of water at its source, and (3) to permit greater entrepreneurial freedom on the part of public water agencies but with substantially curtailed access to sovereign prerogatives and sovereign immunities, a political economist might anticipate distinct improvements in the relative efficiency of regional water industries. The relationship between water pricing and the level of consumer demand and the relationship of the cost of alternative sources of supply to incentives for the reclamation of waste water, for example, clearly indicate that price has a significant effect upon the use of water supplies. Pricing mechanisms are a much more reliable way of taking account of the costs inherent in developmental opportunities than is relying upon restrictive rules backed by criminal sanctions.

With an appropriate system of use charges, many different public enterprises could exercise greater initiative in the pursuit of developmental opportunities. Building works to reclaim waste water is socially more useful than building larger outfall sewers when reclaimed water can be used for recycling through ground-water basins. If water acquires a significant value as reflected in the price that entrepreneurs are required to pay, then incentives will exist to develop market arrangements in the buying and selling of both short-term and long-term water rights. However, water, like land, must have a sufficient economic value before it becomes worthwhile for entrepreneurs to invest time and effort in attending to its use. Public subsidies which deflate the price of water below the costs of production merely encourage overdevelopment, misallocation, and inefficient use, and impede the development of institutional arrangements which are capable of attending to water as a valuable commodity.

If these recommendations of a political economist were followed, several of the costs inherent in present institutional arrangements would continue to manifest themselves. Competitive rivalry, conflict, and public controversy would persist. Conflict provides an opportunity for public officials to use their good offices to search out constructive resolutions to problems. And the service of public officials seeking constructive solutions to community problems is less likely to be performed by underlings in large bureaucratic establishments than by officials who are dependent upon the favor and support of constituents for continuance in office.

The dependence of public officials upon the support of citizens in a democracy, in turn, implies that citizens carry a substantial burden of keeping themselves informed and of making appropriate choices in the conduct of public affairs if they (the citizens) are to use their voice in constructive ways. The existence of overlapping jurisdictions and fragmentation of authority requires a well-informed and discerning citizenry if the basic elements of consensus and agreement are to be preserved in community life. These burdens imply substantial costs for both citizens and public officials in rendering the services necessary to maintain a diverse system of public enterprises.

Conclusion

Different traditions of scholarship in public administration and in political economy use different theories to diagnose social pathologies associated with institutional weakness and institutional failure. These same theories are used to prescribe quite different institutional reforms to remedy those sources of weakness and failure. It is precisely this circumstance that provides an opportunity for social scientists to use the two different theories as bases upon which to organize empirical research to determine which better explains the observed effects.

Finally, policy-makers, who can draw upon the two different approaches and use whatever evidence social scientists are able to develop regarding the predictive and explanatory power of each theory, will be confronted with an opportunity to make a reasoned choice between alternative organizational arrangements for the governance of affairs in metropolitan regions. Are overlapping jurisdictions and fragmentation of authority threatening the elemental conditions of life and provoking an urban crisis? Or is an unresponsive bureaucracy within the big city leading to the breakdown of essential urban services and an erosion of the rudimentary conditions of public life? A choice of the wrong solution will simply exacerbate the crisis! What evidence do we have for the choice of one or the other approach?

REFERENCES CITED

Ashby, W. Ross.
1962 "Principles of the Self-Organizing System." In Principles of Self-Organization, H. von Foerster and G. W. Zopf, eds. New York: The Macmillan Company, 255-278.

Buchanan, James M. and W. Craig Stubblebine.
1962 "Externality." Economica 29 (November): 371-384.
1970 "Public goods and public bads." In Financing the Metropolis, John P. Crecine, ed. Beverly Hills, California: Sage Publications.

Coase, R. H.
1937 "The nature of the firm." Economica 4: 386-485.

Crozier, Michel.
1964 The Bureaucratic Phenomenon. Chicago: The University of Chicago Press, 187.

Hardin, Garrett.
1968 "The tragedy of the commons." Science 162 (December): 1243-1248.

Hirschleifer, Jack, James C. DeHaven, and Jerome W. Milliman.
1960 Water Supply Economics, Technology, and Policy. Chicago: The University of Chicago Press.

Olson, Mancur.
1965 The Logic of Collective Action. Cambridge, Massachusetts: Harvard University Press.

Ostrom, Vincent.
1968 "Water resource development: some problems in economic and political analysis of public policy." In Political Science and Public Policy, Austin Ranney, ed. Chicago: Markham Publishing Company.

Samuelson, Paul A.
1955 "Diagrammatic exposition of a theory of public expenditure." Review of Economics and Statistics 37 (November): 350-356.

Simon, Herbert A.
1964 Administrative Behavior: A Study of Decision-Making Processes in Administrative Organizations. New York: The Macmillan Company.

Tullock, Gordon.
1965 The Politics of Bureaucracy. Washington, D. C.: The Public Affairs Press.

Urban Systems and Engineering, Inc.
1971 Metropolitan Water Management: Case Studies and National Policy Implications. Springfield, Virginia: National Technical Information Service, v.

U. S. Congress.
1969 Joint Economic Committee, Subcommittee on Economy in Government. A Compendium of Papers on the Analysis and Evaluation of Public Expenditures. Washington, D. C.

White, Leonard C.
1926 Introduction to the Study of Public Administration. New York: The Macmillan Company.

Wilson, Woodrow.
1887 "The study of administration." Political Science Quarterly 2 (June): 197-220.

ADDITIONAL REFERENCES

Alexander, Christopher.
1965 "A City if Not a Tree." Architectural Forum 122 (April), 58-62, and (May), 58-61.

Ashby, W. Ross.
1960 Design For a Brain: The Origin of Adaptive Behavior, second edition. New York: John Wiley & Sons, Inc.

Bain, Joe S., Richard E. Caves and Julius Margolis.
1966 Northern California's Water Industry: The Comparative Efficiency of Public Enterprise in Developing a Scarce Resource. Baltimore: The Johns Hopkins Press for Resources for the Future, Inc.

Bish, Robert L.
1971 The Public Economy of Metropolitan Areas. Chicago: Markham Publishing Company.

Buchanan, James M.
1968 The Demand and Supply of Public Goods. Chicago: Rand McNally & Company.
1969 Cost and Choice: An Inquiry in Economic Theory. Chicago: Markham Publishing Company.

Christy, Francis T., Jr. and Anthony Scott.
1965 The Common Wealth of World Fisheries. Baltimore, Maryland: The Johns Hopkins Press.

Committee for Economic Development.
1964 Reshaping Government in Metropolitan Areas. New York: Committee for Economic Development.
1966 Modernizing Local Government. New York: Committee for Economic Development.

Dales, J. H.
1968 Pollution, Property and Prices. Toronto: The University of Toronto Press.

Davis, Otto A., and Andrew B. Whinston.
1967 "On the distinction between public and private goods. American Economic Review 57 (May): 360-373.

Gordon, H. Scott.
1954 "The economics of a common property resource: the fishery." Journal of Political Economy 62 (April): 124-142.

Hirsch, Werner.
1964 "Local versus areawide urban government services." National Tax Journal 17 (December): 331-339.

Landau, Martin.
1969 "Redundance, rationality and the problem of duplication and overlap." Public Administration Review (July-August): 346-358.

Lindblom, Charles E.
1955 Bargaining: The Hidden Hand in Government. Research Memorandum RM-1434-RC. Santa Monica, California: The RAND Corporation.

McKean, Roland N.
1958 Efficiency in Government Through Systems Analysis, With Emphasis on Water Resource Development. New York: John Wiley & Sons, Inc.
1965 "The Unseen Hand in Government." American Economic Review LV (June): 496-506.

Milliman, J. W.
1956 "Commonality, the price system, and use of water supplies." Southern Economic Journal 22 (April): 426-437.

Mishan, E. J.
1969 "The relationship between joint products, collective goods, and external effects." The Journal of Political Economy 77 (May-June): 329-348.

Niskanen, William A., Jr.
1971 Bureaucracy and Representative Government. Chicago: Aldine-Atherton.

Olson, Mancur.
1969 "The principle of 'fiscal equivalence': the division of responsibility among different levels of government." American Economic Review 59 (May): 479-487.

Ostrom, Vincent.
1953 Water and Politics: A Study of Water Policies and Administration in the Development of Los Angeles. Los Angeles: The Haynes Foundation.
1969 "Operational federalism: organization for the provision of public services in the American federal system. Public Choice 6 (Spring): 1-17.
1971a The Political Theory of a Compound Republic: A Reconstruction of the Logical Foundations of American Democracy as Presented in The Federalist. Blacksburg, Virginia: Virginia Polytechnic Institute, Center for Study of Public Choice.
1971b Institutional Arrangements for Water Resource Development. Accession Number PB 207 314. Prepared for National Water Commission. Springfield, Virginia: National Technical Information Service.

Ostrom, Vincent, and Elinor Ostrom.
1965 "A behavioral approach to the study of intergovernmental relations." Annals of the American Academy of Political and Social Science 359 (May): 137-146.
1971 "Public choice: a different approach to the study of public administration." Public Administration Review 31 (March-April): 203-216.

Ostrom, Vincent, Charles M. Tiebout, and Robert Warren.
1961 "The organization of government in metropolitan areas: a theoretical inquiry." American Political Science Review 55 (December) 831-842.

Polyani, Michael.
1951 The Logic of Liberty: Reflections and Rejoinders. Chicago: University of Chicago Press.

Samuelson, Paul A.
1954 "The pure theory of public expenditure." Review of Economics and Statistics XXVI (November): 387-389.

Shields, Currin V.
1952 "The American tradition of empirical collectivism." American Political Science Review 46 (March): 104-120.

Simon, Herbert A.
1946 "The proverbs of administration." Public Administration Review 6 (Winter): 53-67.

Tiebout, Charles M.
1956 "A pure theory of local expenditure." Journal of Political Economy 44 (October): 416-424.

Tolley, G. S.
1969 The Welfare Economics of City Bigness. Urban Economics Report No. 31. Chicago: The University of Chicago Press.

Tullock, Gordon.
1969 "Federalism: the problem of scale." Public Choice 6 (Spring): 19-29.
1970 Private Wants, Public Means: An Economic Analysis of the Desirable Scope of Government. New York: Basic Books, Inc.

Warren, Robert O.
1966 Government in Metropolitan Regions: A Reappraisal of Fractionated Political Organization. Davis, Calfifornia: Institute

of Governmental Affairs, University of California.

Weschler, Louis F.
1968 Water Resource Management: The Orange County Experience. Davis, California: University of California, Institute of Governmental Affairs.

Weschler, Louis F., and Robert Warren.
1968 "Consumption costs and production costs in the provision of antipoverty goods." Paper delivered at the Sixty-sixth annual meeting of the American Political Science Association, Los Angeles, California, September 8-12.

Wilson, Woodrow.
1956 Congressional Government: A Study in American Politics. Originally published in 1885. New York: Meridan Books.

Chapter Eight
Geographic Factors In the Design of Urban Water Management Institutions*

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How does one think in terms of geography about the institutional arrangements for managing urban water resources? The appropriateness of the question derives from two rich and traditional themes of geography: the man-land relation and the spatial order or natural and human systems. Though the study of water-management institutions is thus patently a geographic subject, confusion with the work of other disciplines is likely because of the interest of all the social sciences in institutions.

If we regard natural-resource institutions as the formal and informal social mechanisms that govern individual, group, or government access to earth materials via private or public decision-making processes, it is apparent that there is nothing uniquely geographic in the study of their behavior. But the geographer would be more likely than the social scientist to deal explicitly with the substantive properties of the material on which the institution is operating, in this case water resources, and to incorporate them directly into the behavioral analysis.

The second theme of geography is the spatial arrangements of human and natural systems. Spatial pattern analysis attempts to describe the geographic distribution of the nodes and links that are functionally related to, and expressive of, the processes, transformations, and flows which comprise the resource system. The geographer's concern would be to associate the spatial properties of the urban water network with the urban water institution that manages it. Do they relate conformally or antagonistically? With its emphasis on hydrologic detail and spatial pattern analysis, this theme of geography is more likely to reveal unique insights than the first. It is the one to which this essay is addressed.

At the outset it is important to avoid the pitfalls of the narrowly based engineering-technologic reductionist view of the urban water resource, since such an approach tends to fragment the entire urban water system into separate subsets of physical nodes and links providing for the production, treatment, distribution, use, collection, and discharge of fresh and spent waters. (Reductionism is the view that a complex system can be understood best by studying its parts separately.) Metropolitan areas are well advanced along a geographic and demographic path leading toward vast megalopoli in which independent water supply and/or disposal systems are functionally linked, but may remain managerially independent. In these circumstances, novel spatial-environmental constraints on the operation of the urban water system emerge in metropolitan regions.

Thus, not only have the technologic requirements for designing water facilities in megalopolis been altered, but likewise, a concurrent set of alterations has been made in the design of the institutions capable of satisfying the constraints of the urban water environment. They often go well beyond the relatively simple enlargement of the geographic domain of the water authority; they often touch on the socially sensitive subjects of differential water and waste-treatment pricing, land and water zoning, intake and outfall locations, intra-regional economic development, and core city-suburban relations. How are such conflicts, inherent in the emergent spatial patterns, to be resolved? The complexities of water management in metropolitan regions, in short, have come to resemble a compote of technologic and behavioral elements, each retaining its form, all stewed in the syrup of urbanism.

The Urban Hydrologic Cycle

As intimated earlier, geography plays a bridging role between the natural and social sciences. The study of institutions for managing urban water would commence with the identification of the pathways and transformations of the hydrologic cycle in metropolitan areas, where nature is disturbed severely. The object of this approach is to ascertain whether the separate and collective operation, design, and goals of water institutions are conformable with the altered hydrologic regime, or are vestiges better adapted to a pre-megalopolitan era.

The hydrologic cycle may be described initially by the equation of continuity:

(1) Inflow = Outflow + Storage Change.

On land, equation (1) may be disaggregated into

(2) Precipitation = Evaporation + Transpiration + Soil Water + Ground Water + Runoff + Storage Change.

Equations (1) and (2) are traditional statements of the cycle. They specify two of its six dimensions: mass and state. The unspecified dimensions are quality, time, location, and landscape. The common habit of hydrologists of thinking of the water cycle in dimensions of mass and state, useful as it is, may have much to do with the inadequacy of historic approaches to the study of metropolitan area water resources. The complexities of urban water studies involve critical linkages among all dimensions -- mass, state, quality, time, location, and landscape. They provide a good jumping-off point for the study of urban water problems.

The effect of urbanization on all six dimensions is profound and interconnected (Savini and Kammerer, 1969; Lull and Sapper, 1969; Leopold, 1968; Spieker, 1970):

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(1) *Mass* -- Urbanization generates an increase in population and economic activities, and hence in the demand for water and the ensuing disposal of waste water. In most instances water is imported from distant catchment areas because the watershed occupied by the urban place cannot satisfy demand. New York City and Los Angeles are cities where large-scale water-importation has become necessary. On the other hand, run-of-the-river systems like Philadelphia or New Orleans can use the water of major streams flowing through the region. Other urban areas, such as Nassau County, Long Island, New York, and Houston, Texas, rely on local aquifers; such reliance is equivalent to a vertical transfer of water analogous to a geographical import. In most cases urbanization leads to an increase in the volume of water throughout above the levels provided by the undisturbed hydrologic cycle. Even for the exceptional cases noted above, massive withdrawals from adjacent streams and local aquifers put stress upon the hydrologic regime by altering flow pathways.

(2) *State* -- As water moves through the hydrologic cycle it experiences transformations of state -- liquid, solid, and gaseous phases. Since urbanization alters the surface and thermal properties of the watershed, transformations in state are effected. Interventions in natural changes of state are seen in the runoff-rainfall ratio, the percent of a given storm's precipitation that moves down slope as liquid and is discharged into a receiving body of water. The impact of urbanization is to increase the runoff-rainfall ratio or the recovery of rainfall. The change is caused by the removal of the vegetative cover, surface paving, and the introduction of storm sewers. In effect, a man-designed watershed has been imposed on the natural surface. Replacing of plants by an impervious surface reduces opportunities for water to vaporize by transpiration from plants and evaporation from the soil. Infiltration is decreased markedly; the surface water is collected rapidly and transported away from the places of receipt. Interception, retention, and evaporation from structured surfaces is increased, but this result is more than offset by the decline in natural evapo-transpiration.

There are two additional relatively minor changes of state induced by urbanization. Discharges of particulates into the atmosphere increase the nuclei of condensation that encourage the transformation of vapor into liquid droplets. If the latter coalesce, precipitation occurs. The second change of state results from the hastening the process of snowmelt, a transformation from the solid to the liquid phase. In the metropolitan area snow and ice are serious traffic hazards and thus the incentive to remove them is high. Removal is accomplished by two methods: (1) physical removal and dumping, and (2) induced snowmelt by the application of salts to the snow surface. In the urban core, higher ambient and surface temperatures directly hasten the melting process.

(3) *Time* -- Accompanying the changes in mass and state induced by urbanization are shifts in the temporal properties of the hydrologic cycle. Not only is the runoff-rainfall ratio altered, but the time of arrival of the runoff in the receiving water is shortened. Thus, a reinforced peaking effect occurs and, for streams, the stage is much higher than under natural conditions. As the discharge flood wave moves downstream the flood-damage hazard is increased.

Additional temporal shifts are induced by impoundments on the stream to regularize flow. Reservoirs are managed to satisfy requirements for a dependable yield of potable water, to reduce downstream flood hazards, to provide releases to downstream areas for consumptive and non-consumptive uses, and for hydropower.

(4) *Quality* -- The broad set of parameters that describes the quality of water may be divided into subsets of variables, dissolved solids, suspended solids, dissolved gases, temperature, and resident organisms. These are severely altered by urban activities when they occur on lands tributary to receiving waters that have replaced pre-urban activities. The alterations show temporal and discharge variations that reflect the rhythm of urban activities, stream discharge patterns, hydraulic behavior, and the seasons. Domestic and industrial spent-water discharges place organic loads, which often include synthetic organic compounds and toxic heavy metals, on receiving waters. Sewage-plant treatments hasten the mineralization of organic matter, and the effluent contains available nutrients and chlorine doses. Residual accumulations of sludge commonly are dumped into nearby waters. Surface runoff from surrounding urban watersheds carries road salts, fertilizer nutrients, oils, and sediments. The use of water for industrial cooling raises its temperature. The general thrust of these activities is to reduce the dissolved oxygen content of urban waters, often to the septic level. Since the dissolved oxygen capacity of water varies inversely with temperature, the summer season is likely to be critical, particularly if it coincides with low flow and/or increased effluent discharge. The impact of these adverse changes in quality often is cumulative, upstream to downstream. Within the constraints of their hydrologic behavior, the qualities of ground water, estuaries, and marshes also are adversely affected by the processes of urbanization. As expected, changes in quality parameters, in kind-and-concentration ratios, have a profound impact not only on inherent water properties but also on the suitability of the body of water as an aquatic habitat. This, of course, is reflected in altered micro-and-macro biologic populations.

(5) *Location* -- Accompanying and implicit in the changes caused by urbanization in the above four dimensions is the spatial rearrangement of water intakes, outfalls, and pathways. Massive inter-basin water transfers may occur so that natural flows are diminished or increased. The construction of a sewerage and/or water-supply network actually imposes a man-designed watershed (sewershed and distribution net) on the natural one, which may be obliterated. The whole set of water uses associated with urban land activities (residential, manufacturing, commercial, public, transport, recreational) dictates a spatial pattern of water transformations. In what manner are the locational patterns of the activities internally related to each other in their processes, intakes, outfalls, and pathways? Beyond that, how does a water supply-water disposal system externally relate to adjacent systems when they are connected by natural hydrologic pathways?

The internal and external expansion of cities and their aggregation into metropolitan regions makes the intra- and extra-regional locational structures of water systems of critical importance for urban areas dependent on run-of-the-river, imported surface, and groundwater sources.

(6) *Landscape* -- Another element of the water regime, and one that deserves greater attention, is its recreational and ambient attractiveness. The impact of urbanization in its extreme form is to transform a

pristine stream, lake, marsh, or shoreline into a foul, noxious, body of water littered with the flotsam of an industrial civilization. The impact on the amenity and recreational utility of a body of water that urbanization causes is the result of a transformation of the hydrologic regime that is analagous to the effect of a fall in dissolved oxygen on the aquatic biologic population. For both, quality parameter changes have disturbed the ability of the water environment to support populations of living organisms. Fortunately, the responses of humans are less critical, in the short run, than aquatic organisms.

Given the fact that urban regionalization has altered the basic dimensions of the hydrologic cycle, the question arises: Have water management institutions responded to the altered resource in ways that will permit more effective allocation? Admittedly, the new situation creates problems of adjustment, but it presents also opportunities for raising the level of managerial efficiency. Increased concern must be given to intra- and inter-system linkages and to the common-property aspects of waste-receiving bodies of waters. Higher runoff-rainfall ratios suggest that the hydrologic changes induced by urbanization may contribute to water supplies. Water-based recreational activities, always an important part of this country's leisure-time fare, continue to expand. Water-based activities are readily accessible and offer recreational experiences that vary with the seasons. Are water institutions alert to these new demands and opportunities?

The scenario of the urban hydrologic transformation is being played on a stage by a cast that varies from region to region. While the local hydrography is unique, it is composed of some combination of the following natural bodies of water and constructed facilities: (1) streams -- free-flowing, impounded, tidal; (2) lakes, ponds, and fresh marshes; (3) aquifers -- surficial, confined, local recharge, distant recharge, hard fissured rocks, consolidated sediments, porous sediments, hydraulically related to coastal marine waters; (4) offshore waters -- open ocean, estuaries, bays, inlets, tidal marshes; (5) storage reservoirs -- impoundments, power plants; (6) water canals -- treatment plants, intakes, conveyances, direct domestic and industrial waste channels; (7) sewage treatment plants, outfalls, sanitary sewers, storm sewers, conveyances, by-pass flow regulators, septic tanks, recharge wells, injection wells.

The cast of characters consists of individuals, commercial and manufacturing concerns, franchised private agencies, public agencies, quasi-public agencies, judicial and legislative bodies at all governmental levels, the general public, and organized public groups.

The plot, like the natural and designed hydrography and the cast, varies from place to place, as the players assume roles that reflect unique local histories and power structures. But all are present in active roles, or waiting in the wings for their cues.

The theme, however, is always the same -- the resolution of conflicting interests in gaining access to the limited water resource. Thus, adversary relationships develop. As the resource becomes more limited, opportunities for conflict grow and the need is greater for institutional arrangements that minimize friction.

Institutional Spatial Interdependencies in Urban Regions

A crucial factor to be considered in the redesign of urban water institutions is the geometry of an entire regional water network. The process of urban regionalization leads to the aggregation of the demand and supply of a wide variety of goods and services, of which water is only one. ("Aggregation" is here used in a physical and geographic sense, not as a statistical collapse of data.) The spatial-urban ecologic aggregation of water needs induces fundamental changes in the local natural hydrologic cycle. Institutions that have evolved to manage water where urbanization is slight and hydrologic disturbance is modest and local are poorly adapted to its management at a concentrated level with more severe intervention. As the process of urbanization continues, the gulf between initial institutional capacity and the managerial requirements of the altered hydrography widens; the resource is utilized less and less efficiently. Since water is an irreplaceable essential good offering very limited options for substitution, marginal costs (either monetary or in the form of environmental degradation), may rise steeply, or may even place an absolute barrier on further growth.

If, however, part of the hydrologic constraint on urbanization can be attributed to institutional inadequacies, the obvious thrust of a relief strategy would be primarily social. Operationally, the strategy set is drawn from a wide assortment of combinations of political, engineering, and environmental variables, such as area serviced, conduits, treatment plants, impoundments, and water-quality parameters.

Lack of conformity between the altered behavior of the hydrologic cycle under metropolitanization and the capacities of urban water institutions to manage the supply wisely are due to cultural lag. A widening disparity between the water flux and agency function eventually may threaten the viability of metropolitan areas.

Despite the obvious link between water supply and water disposal systems, the common practice has been to manage and operate them separately. A similar pattern of operational independence has characterized the management of water-supply and water-disposal systems that adjoin. At an early state of urbanization, natural processes are able to tolerate the environmental stress. Greater development, however, causes the resulting adverse hydrologic interdependencies to push toward the ecologic limits of spatial agglomeration.

Independent agency behavior, tolerable at early stages of urbanization, becomes intolerable above an agglomeration threshold, and some degree of managerial association then becomes imperative. The level of this critical point is determined by many regional variables: natural hydrography, altered hydrography, density, distribution and kind of land use, water service demand. But for each region there is a development level beyond which the continued separate operation of water agencies acts as a deterrent to further growth.

There are three types of agency interactions in metropolitan areas: supply supply, disposal disposal, and supply disposal. For each pair two extreme managerial linkage states may be defined: dependent and independent. Two agencies are said to be in a managerially linked state when the operational decisions of one agency are made with due regard to the decisions of another agency, after joint consider-

ation of the combined impact of their decisions on the water service and/or the natural body of water. While a range of managerial associations is possible, six pure linkage states can be identified. In a large urban area, such as the New York-New Jersey Metropolitan Region, all pure end-member and intermediate states are present.

The managerial implications of the altered dimensions of the hydrologic cycle under the agglomerating impact of the urban-regionalizing process are indicated by a review of the three types of agency interactions:

1. *Water Supply Facilities, Supply Supply Relations.* In the 19th century and early 20th century city, after internal sources had become insufficient, water was obtained by gaining access to sparsely settled catchment areas beyond the city's boundaries. Water rights were obtained by land purchase or by enabling acts of the state legislatures. These acts protected the future water rights of the residents of the service area. Unless the city purchased the watershed, the land could be settled and developed. As demand increased in the city, additional rights were secured, usually for more distant locations. The development of the New York City Water Supply System is an example, having developed successively the Croton, Catskill, and Delaware divisions at progressively greater distances.

Urban areas dependent on ground water met the increase in demand by greater pumpage from existing wells, the development of new wells, and tapping deeper aquifers. This was and is the pattern on Long Island, New York. Run-of-the-river systems responded to their growth by increasing withdrawals (subject to flow limitations), by acquiring new downstream riparian rights, and by increasing release requirements.

As long as sources were available the dependable yield could be satisfied by enlarging the catchment area, horizontally or vertically. Meanwhile, other communities, faced with similar growths in demand, expanded their source areas. Eventually, the catchments impinged on one another. Under the pressure of metropolitanization, what had formerly been untapped interstitial open space was transformed into competitive source areas.

The geographic expansion of water sources into interstitial areas may occur in three hydrologic regimes: (a) dispersed-surface upstream watersheds from which water is collected and stored in impoundments; (b) main stream run-of-the-river sources in which increased intake points and volume may affect dependable yield and water quality (as, for example, the competition for Hudson River water between New York City and Poughkeepsie, or the competition for Delaware River water between Philadelphia and the Delaware division of New York City; in both instances greater upstream withdrawal threatened downstream intakes with brackish water); and (c) groundwater aquifers in which more pumpage and/or wells can cause a coalescence of depression cones and falling regional water tables (in coastal locations water quality may deteriorate due to intrusion of ocean water, as in Long Island, New York).

Competition may result also from the spreading of source areas enclosed within a larger catchment. When watershed allocations were made to large core-city systems, the source areas were sparsely settled and local demand for water was low. The legal assignment of water rights protected the interests of the enclosed local communities by requiring the assignee to provide potable water on request at an equitable price. The communities also had the option of developing independent systems, which many did. As urbanization came to the watershed lands, the increased local water demands were met by expansion of the independent facilities, by the core-city system, or by a combination. The pattern of internal expansion within segments of the established catchment area is evident in many metropolitan regions, for example, in Westchester and Putnam counties, New York, where population growth is reducing the water yield of New York City's Croton Division to the City; in fact, the City sells water from its upstate divisions to communities in the two counties (City of New York, 1970).

The decline in the availability of new water source areas, coupled with the expansion of distribution facilities, was the driving force behind the consolidation of private and public water agencies. The consolidation process was gradual and partial. Hence, a wide assortment of water-agency sizes, structures, and linkage arrangements can be observed in urban regions, from the large core-city system to the self-supplied individual homestead or company. Usually, the core-city waterworks is the largest. During its growth, it may have assumed supply and/or distribution responsibilities in whole or part for satellite communities (Zobler, Carey, Greenberg, Hordon, 1969).

Water agencies have available to them for increasing supplies options other than expanding into new source areas such as improved management of present watersheds through vegetation, land use, and engineering controls; higher levels of raw water treatment as source quality deteriorates; use of renovated spent water directly or by regulating effluent treatment levels. The use of these alternatives depends in part on the behavior of the waste-water disposal system.

2. *Water Disposal Facilities, Disposal Disposal Relations.* Water deliveries to urban regions have several origins: (a) intra-regionally produced surface and ground water, (b) extra-regionally imported surface and ground water, and (c) precipitation receipts that do not enter the water-supply system. Potable water derived from (a) and (b) has personal, sanitary, commercial, public, and industrial uses. As a result of these uses the quality is degraded; such water is described as spent water. Precipitation directly deposited on intra-regional surfaces, particularly in a built-up area covered with impervious materials, has a high runoff coefficient. If precipitation receipts are high the runoff may create a nuisance or hazard; it is referred to as storm water or wet-weather flow. Storm water also flushes and cleans surfaces of accumulated debris, particulates, wastes, and road salts. Both spent waters and storm waters are discharged into natural water bodies adjacent to or within the region -- streams, lakes, aquifers, estuaries, or oceans; these are called receiving waters. Runoff comes also from unpaved vegetated surfaces, carrying suspended sediment and dissolved chemicals. Finally, aquifers discharge into water bodies. The greater the degree of urbanization, the smaller the contribution of the latter two sources.

Spent and storm waters that enter natural water bodies may undergo renovating treatment ranging from none to almost total. The quality of most renovated waste water, compared with that of water naturally recharged is much lower so that it generally has a degrading impact on the receiving water.

Spent and storm waters are collected by a sewerage network through a system of drains, sewers, laterals, and interceptors that collect them, drain them, and conduct the effluent away from the place at which it is generated. Except for the storm water and the overland and ground water flows from vegetated surfaces, the effluent results from the use of water deliveries made by (a) or (b) above. The point at which the sewerage system discharges water into the receiving body is called the outfall. Outfalls may take several forms. If the receiving water body is an aquifer, effluent discharge may be from a recharge basin, a surface spreading area, a water sprinkler, an injection well, a cesspool, or a septic tank. In the first three, the effluent is introduced directly into the aquifer. The discharge, merging with the antecedent ground water, may percolate into a stream or lake. If the receiving body is surface water, stream, lake, bay, estuary, or ocean, the outfall is simply a pipe carrying the effluent directly from a single user, household, commercial or industrial source, to the receiving water; or it may be the end of a sewer line that has collected the waste of several sources; or it may be the outlet of a sewage plant after the waste has been subjected to various levels (primary, secondary, tertiary) of treatment.

Most older sewerage systems are combined; that is, the storm water and the sanitary waste are combined and conveyed by a single conduit to the treatment plant. Since during wet weather the volume of storm water is increased, the combined flow may exceed the capacity of the treatment plant. To prevent flooding of the plant, by-pass regulators divert some of the combined flow directly into the receiving water in an untreated raw state. Newer sewer lines separate the two flows.

The water-disposal facilities of drains, sewers, soil pipes, laterals, interceptors, regulators, sewage plants, and outfalls comprise a planned network designed to remove waste and storm water from an urban area which might appropriately be called a sewershed. The sewershed, like the supply system, is imposed on the natural drainage pattern and grows outward into unsewered interstitial areas, as the rise in the geographical concentration of waste-generating points resulting from urbanization increases the need for disposal services. Similarly, older and smaller systems and units may be absorbed as expansion occurs. However, the growth-inspired competition between sewerage agencies differs from the competition between water-supply agencies. While water agencies conflict with one another over upland source watersheds or over stream intakes, sewerage agencies compete over disposal facilities at downstream outfalls.

Urban growth increases the volume of spent water, which, for a given treatment level, may be disposed of in three ways: (1) increase of the discharge at a fixed number of outfalls, (b) maintenance of fixed discharges at an increased number of outfalls, and (c) some combination of (a) and (b). Varying the level of spent water treatment prior to effluent discharge increases the number of available options.

The competition between expanding water supply systems is over the volume of raw water generated in the source-area watershed. In expanding disposal systems, however, the competition is over the assimilative capacity of the receiving body of water. This capacity depends on four factors: (a) hydrologic properties of the receiving water body, (b) effluent discharge, (c) effluent quality, and (d) spatial distribution of the outfalls. Each is subject to managerial control. The arrangement of the locus of outfalls must satisfy the desired hydrologic state of the receiving waters. Here "locus" is used both in its general sense of place and in its mathematical sense of a set of points every one of which satisfies a given condition and which contains no point that does not satisfy this condition. Hence, the spatial pattern of outfall locations is related necessarily to the levels of each element of the variable set defining flows at each outfall and to the level of each element of the variable set defining the state of the receiving waters.

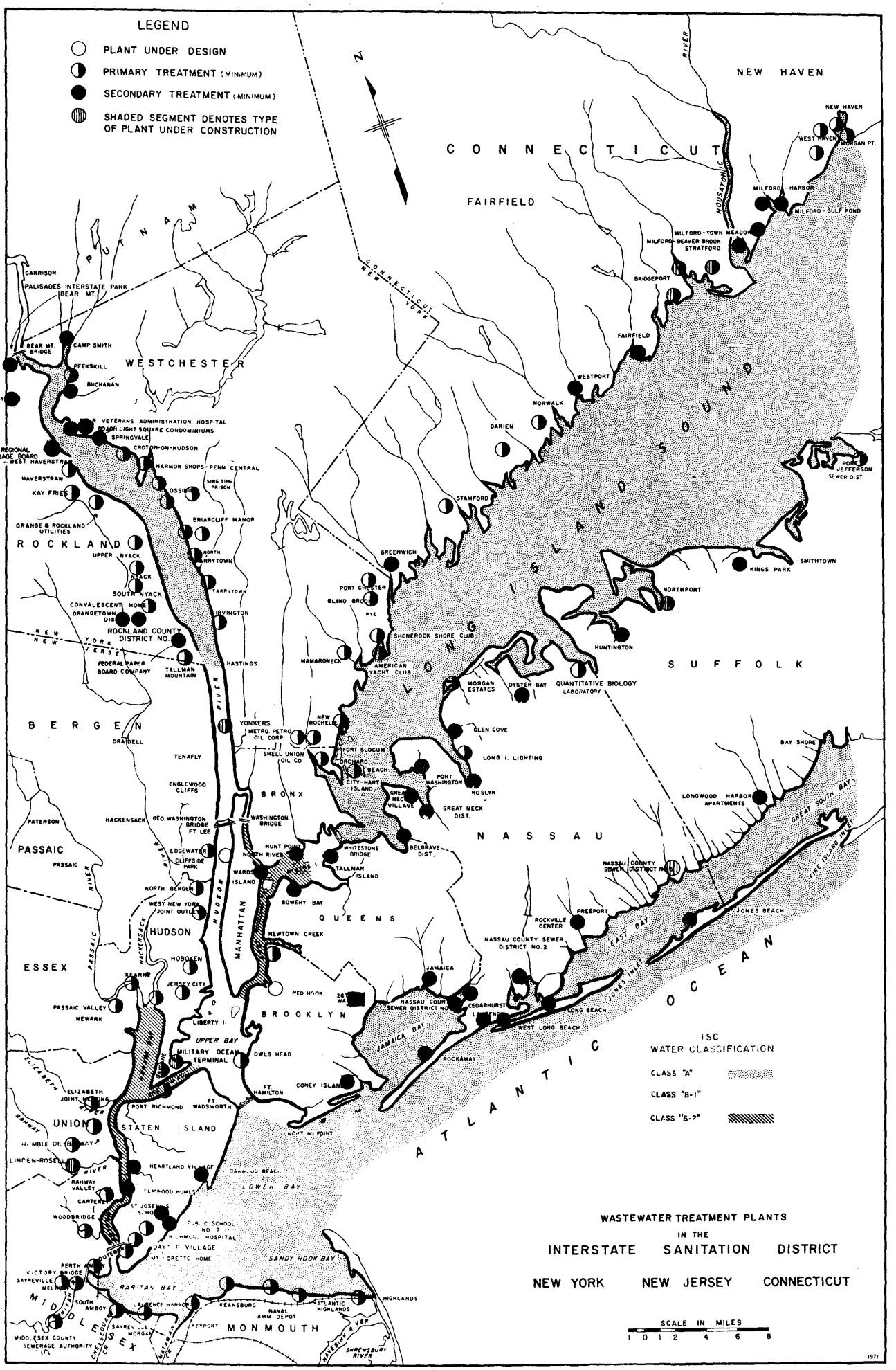
In urban metropolitan regions competition for the assimilative capacity of the receiving waters may reach surprising intensity. Where independent decisions are made, the state of the receiving water may be driven down to a near septic or septic state by crowding of outfalls under a "tragedy of the commons" syndrome (Hardin, 1968). In the New York-New Jersey metropolitan Region, for example, sewage treatment plants serving 15 million people and many industries discharge two billion gallons per day of primary and secondary effluent into the estuary of the New York Bight (Interstate Sanitation Commission, 1970). In addition, the receiving waters must accomodate direct industrial, surface runoff, raw sewage effluent, and degraded stream discharges. (Twenty percent of New York City's sanitary waste is untreated.) The shoreline of the estuary is lined with 124 treatment plants and pipe and sewer line outfalls. Figure 1 shows the distributional patterns of treatment plants. Estuaries are favorite receiving waters for the effluent discharges of coastal regions because their sea level elevations make it possible to design gravity-flow sewerage systems.

3. *Supply Disposal Relations.* The water supply and the water disposal systems are linked hydrologically by equation (1), the inflow-outflow equation, which is a statement of the Law of Conservation of Matter. During a given time interval the total inflow to a given area must equal the total outflow plus the change in storage. Water deliveries to multiple points in the region are the inflows that must be exported after use.

The natural watershed tends toward an equilibrium between the wearing down of its surface and the stream energy required to remove the rock waste. Precipitation receipts from the atmosphere fall on the surface, cause erosion, and generate waste; the waste is removed by streams whose load capacities are defined by their hydraulic properties (channel slope and cross-section, discharge). The stream develops an average equilibrium profile that affects this relationship.

Similarly, the waste-water disposal system must be in equilibrium with the water supply system. Here, however, the analogy between the works of nature and man ends because of built-in rigidities. In the man-designed system, supply and disposal attain a partial and limited balance because of (1) inadequate design of sewer capacities to handle both sanitary waste water and storm water, and (2) faulty definition of the boundaries of the disposal system which are assumed to meet at the outfall.

Possible inadequacy of design is indicated by (1), which may lead to flooding or diversion of excess flows by regulators into adjacent receiving waters. In both cases the overflow may place stress upon the water supply system. The boundaries of the disposal system are not defined by the service area divides of the sewershed that meet at the outfall, but continue


LEGEND
PLANT UNDER DESIGN
PRIMARY TREATMENT (MINIMUM)
SECONDARY TREATMENT (MINIMUM)
SHADED SEGMENT DENOTES TYPE OF PLANT UNDER CONSTRUCTION
CONNECTICUT
NEW HAVEN
FAIRFIELD
WESTCHESTER
PUTNAM
ROCKLAND
BERGEN
PASSAIC
HUDSON
ESSEX
UNION
MIDDLESEX
MONMOUTH
BRONX
MANHATTAN
QUEENS
BROOKLYN
STATEN ISLAND
NASSAU
SUFFOLK
LONG ISLAND SOUND
ATLANTIC OCEAN
NEW YORK
NEW JERSEY
HOUSATONIC RIVER
CONNECTICUT
HUDSON RIVER
PASSAIC RIVER
HACKENSACK RIVER
RARITAN RIVER
RARITAN BAY
SANDY HOOK BAY
UPPER BAY
LOWER BAY
JAMAICA BAY
EAST BAY
GREAT SOUTH BAY
JONES INSET
FIRE ISLAND INLET
NEWTOWN CREEK
ISC
WATER CLASSIFICATION
CLASS "A"
CLASS "B-1"
CLASS "B-2"
WASTEWATER TREATMENT PLANTS
IN THE
INTERSTATE SANITATION DISTRICT
SCALE IN MILES
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below the outfall, where they spread to form an effluent plume in the receiving body of water. How far do the sewershed boundaries extend below the outfall? The geographical limits can be defined by the set of flow-and-quality parameter values desired for the receiving waters, which may be above, below, or equal to antecedent levels. The size of the area enclosed by the boundaries thus reflects the natural recuperative powers of the receiving water, the quality and flow of the effluent, and the goals established for the receiving water. Clearly, however, if the quality of the receiving water is diminished by effluent discharge, the limits of the disposal system area extend beyond the outfall, and the water supply system may undergo stress if its intake falls within the zone of degraded water. If the notion of supply is extended beyond the production of potable water to include recreational uses and fisheries, the possibility of stress potential is increased.

As a water transport network, the waste disposal system is the inverse of the supply system. It collects spent water from many points or sources and makes delivery to a greatly reduced number of outfall points. Prior to discharge, the waste water may be subjected to varying levels of treatment. The supply system, in contrast, distributes water from a few-source intakes to many-point sinks. (The places of initial precipitation receipts are widely dispersed, but flows are concentrated by natural drainage at the intake.) Prior to distribution, raw water may be subjected to varying levels of treatment.

The two systems may be connected at linkage nodes, where quality transformations occur that convert potable water to spent water, and raw water and/or spent water to potable water. These nodes are (a) distribution nodes, where the delivered-to-customer water is used and transformed to spent water, which then enters the disposal system; (b) the outfall node, where spent water, with or without treatment, leaves the disposal system and is discharged into a receiving water; and (c) intake nodes, where raw water is withdrawn from a receiving water and, with or without treatment, enters the supply system for transport to the distribution nodes.

Urban regionalization increases the likelihood that nodes (b) and (c) will be linked; that is, the receiving water of a disposal system will be the water source for the intake node of a contiguous supply system. Examples of such links are common in megalopoli. In the New York-New Jersey Metropolitan Region the decline in water quality of the upper aquifers on Long Island due to cesspool and septic tank effluent has been responsible for tapping lower aquifers (Cohen, Franke, and Foxworthy, 1968). Increased settlement on the Croton Watershed has forced New York City to chlorinate some streams directly. In Northern New Jersey the Passaic Valley Water Commission has referred to itself as the tertiary treatment plant of the Passaic Valley Sewerage Commission. The emergence of subsystem links creates managerial necessities and opportunities since the events occurring at them may be counterproductive or supportive of regional water goals. The former are common; the latter are in the early stage of exploration.

Efficiency in Urban Regional Water Use

Having examined in the previous sections selected spatial engineering-hydrologic features of urban regional water supply and disposal facilities, we consider next their impact on system efficiency. Are there opportunities for making more effective use of the total water resource in urban regions that derive from the agglomerating process? Can an apparent adversity be turned into an advantage? As in the previous section, the three types of agency interactions are treated separately.

1. *Supply Supply Relations.* The water needs of urban metropolitan regions are frequently satisfied by separate agencies operating independently with limited connections, competing for an increasingly scarce resource. In the New York-New Jersey Metropolitan Region, for example, more than 400 agencies provide 2.2 billion gallons of water per day to 16 million people. In an environment of growing water scarcity the central spatial efficiency question is: Are opportunities for ameliorating the shortage and contributing to the stability of the region to be found in the spatial arrangement of the individual agencies? If ways can be devised for transferring water from agencies with surpluses to those with deficits, network connections can be employed to relieve stress. During a period of stress, temporary or prolonged, the distribution of water in the region as a whole may exhibit deficiencies in one location and surpluses in another. This situation occurred in the New York Metropolitan Region during the drought of the mid-1960s because decisions of separately managed agencies were made without regard to their effects on the distribution of other agencies (Zobler, Carey, Greenberg, Hordon, 1969). Indeed, few agency linkages existed. While the object of an individual water agency is to deliver water from its source to its consumers, the object of the regional supply system is to produce and convey water from all sources to all sinks; the regional goal is not satisfied if a shortage exists at any delivery node while a surplus is available anywhere else in the region. (Surplus includes stored and spilled water.) A shortage that is not distributed uniformly may be remedied by cooperation between agencies. A uniformly distributed shortage may require an increase in some source yields.

As urbanization increases the demand for water in the region, momentary stress is transformed into permanent shortage. The establishment of linkages between agencies may serve to reduce the number of incidents of deficiency, thus raising the efficiency level of the network. Efficiency may be expressed as a ratio between total water actually delivered and total water input. With more efficient delivery it may be possible to increase final deliveries from a fixed water input.

Opportunities for ameliorating regional water shortages are expanded also if water production is below safe yield, or if dependable yield can be increased with additional impoundments, in one part of the region, when production in another part presses on maximum yield. Intersystem linkages are required to develop these alternatives. A study of agency relations in the New York-New Jersey Metropolitan Region indicated that the region could meet its projected water needs beyond 1985 from presently available and developed sources and unharvested flows if major agency linkages were incorporated into the network. Possibilities exist also for massive conjunctive management of Long Island ground water and upstate surface water (Zobler, Carey, Greenberg, Hordon, 1969).

2. *Disposal Disposal Relations.* For water supply agencies, efficiency may be measured as a ratio between water available and water delivered. For water disposal agencies, regional efficiency may be expressed as a ratio between the available assimilative capacity

of the receiving waters and its actual utilization at a fixed level of treatment and with a fixed set of water quality standards. As shown by Figure 2, the assimilative capacity of a receiving body of water reflects its hydrologic properties, its natural impurities, and the standards set for it.

The receiving water's ability to assimilate organic effluents varies with the season because of the inverse relationship between dissolved oxygen and temperature, and, for most streams, because of variations in discharge. The total volume of effluent that a receiving body of water is able to accomodate without deterioration can be increased at higher effluent treatment levels.

The range of assimilative capacities represented by Figure 2 is for a given receiving body of water, or a finite segment thereof, such as a stream or estuary. However, receiving waters, particularly estuaries or streams, have strong lateral flows, so that the initial effluent load is transported and dispersed while the effluent continues to use the assimilative capacity. Transformations in the segment thus relate to adjoining segments from which it receives inflow and into which it discharges. The relation between the oxygen demand of the effluent (biochemical oxygen demand) and the dissolved oxygen in the receiving water can be described by first-order differential kinetic equations.

Hence, outfall spacing and treatment level interact with hydrologic parameters to determine the reduction in water quality. Figure 3 shows the oxygen sag response curve of a body of water to an effluent charge as a function of time-distance. As in the previous case, assimilative capacity is determined also by water standards. Standards are violated when the effluent load drives the actual dissolved oxygen below the level allowed by the water standard. An efficiently operating waste disposal system would have its outfalls spatially distributed so that, for a given level of treatment assigned to each outfall, no receiving water has unutilized assimilative capacity and none has overutilized capacity, according to its standard. When the average regional assimilative capacity has been exhausted, the average regional treatment level must be raised, the standard lowered, or the load reduced. For successful managerial interventions average regional values would have to be spatially disaggregated to a segment-by-segment level. The alternatives are to lower water standards (degrade the environment), or reduce effluent discharge (curb growth), or raise treatment (increase cost).

It follows from the above that an optimal regional waste-water management scheme can be developed. The objective function of an optimal solution would be to maximize the natural assimilative capacities of the region's receiving waters (or minimize the level of effluent treatment) at fixed standards for a given set of segments with known dimensions and hydrologic parameters so as to balance the capacity of the receiving waters with the amount of effluent to be put into them. Alternative solutions might be found by manipulating the locational patterns of the outfalls and segments. A zoned optimization model based on cost has been developed for the Delaware estuary by the Federal Water Quality Administration (Smith and Morris, 1969).

The prevailing tendency, encouraged by federal and state policy, is to support the construction of large regional plants at the lowest point in the drainage basin, to replace small widely distributed plants. Such a policy appears to conflict with an optimization procedure which seeks to maintain a more uniform level of regional environmental quality. It would concentrate effluent impact in the lower parts of the basin while by-passing the natural assimilative potential of upstream areas.

The impact of sewage-treatment-plant locational strategies was simulated on the Passaic River, New Jersey. A decentralized pattern was compared to a centralized one. The impact of the regional (centralized) plant on stream quality was to exacerbate pollution in the downstream reaches while slightly improving upstream water. A dispersed (decentralized) locational pattern, however, improved downstream water without adversely affecting upstream quality (Carey, Zobler, Greenberg, Hordon, 1972).

3. *Supply Disposal Relations*. When two systems establish links they become, in effect, subsystems of a larger system, since the outputs of one are the inputs of the other. Explicit recognition of a relationship that is implicit to the hydrologic cycle opens the door to managerial opportunities at the linkage node. Nodal management should be directed toward achieving transformations and/or flows that support the goals of the influent subsystem. Otherwise, relations are counter-productive. Linkage-node management contributes to overall system efficiency in the sense that a greater yield (of water supply and effluent disposal) is obtained from a fixed input.

One hydrologic manifestation of the process of urbanization is an increase in the runoff-rainfall ratio. In a sense urbanization solves its own water supply needs. Using a water-balance model approach, an estimate was made of the increase in runoff as a result of the metropolitanization of the non-core areas of the New York-New Jersey Metropolitan Region (Muller, 1969). The estimated coefficient, defined as the average annual increase in runoff due to urbanization, was 0.032 million gallons per square mile for upland counties and 0.056 for lowland counties. The average annual yield increase for the region was estimated to be 420 million gallons per day.

Whether or not this internally generated increment to the water supply can be used as a water source or for disposal of spent water depends on the relation between the two subsystems. Most of the water is treated as storm runoff. It seems reasonable to expect that a portion of the yield could be harvested, stored, and used as raw water or to augment low flows, thereby maintaining the assimilative capacity of streams during the summer season when bodies of water are under simultaneous stress from supply and disposal pressures. Treatment costs of influent water intended for potable uses rise rapidly in urban regions as discharge falls (Fuchs, 1968).

The disposal of storm water in a combined sewer system is a good example of counter-productive linkage node management. Instead of using a portion of this flow to satisfy some part of the region's supply needs, to provide possible recreation, or to augment flow, it is combined with sanitary waste and discharged untreated. The cost of reconstructing the older combined sewers is prohibitive, but following the use of bypass holding lagoons by subsequent treatment would lessen the high pollution loads imposed on receiving waters.

Figure 2. Levels of Assimilative Capacity (Slightly modified from Smith, 1970).

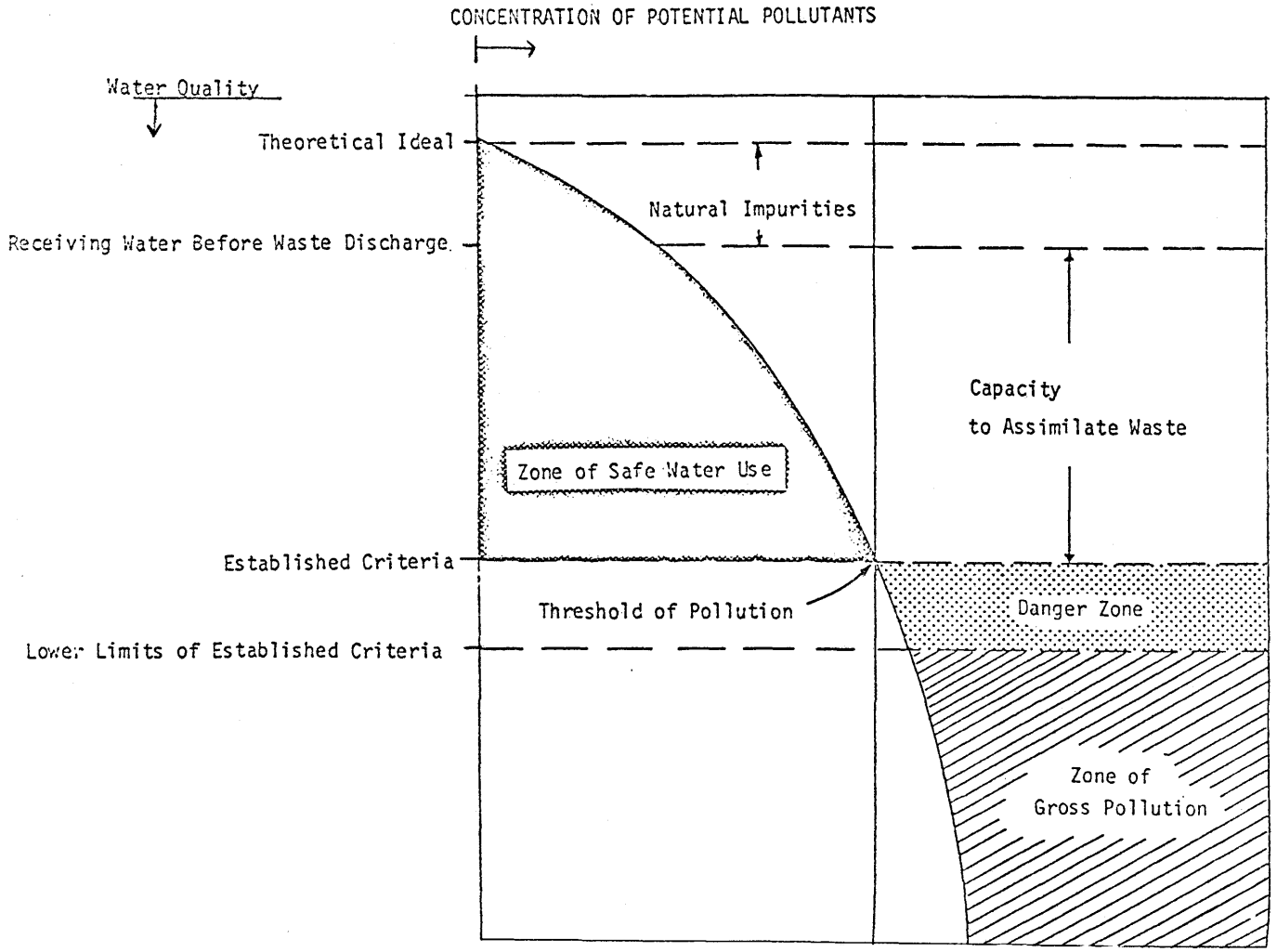
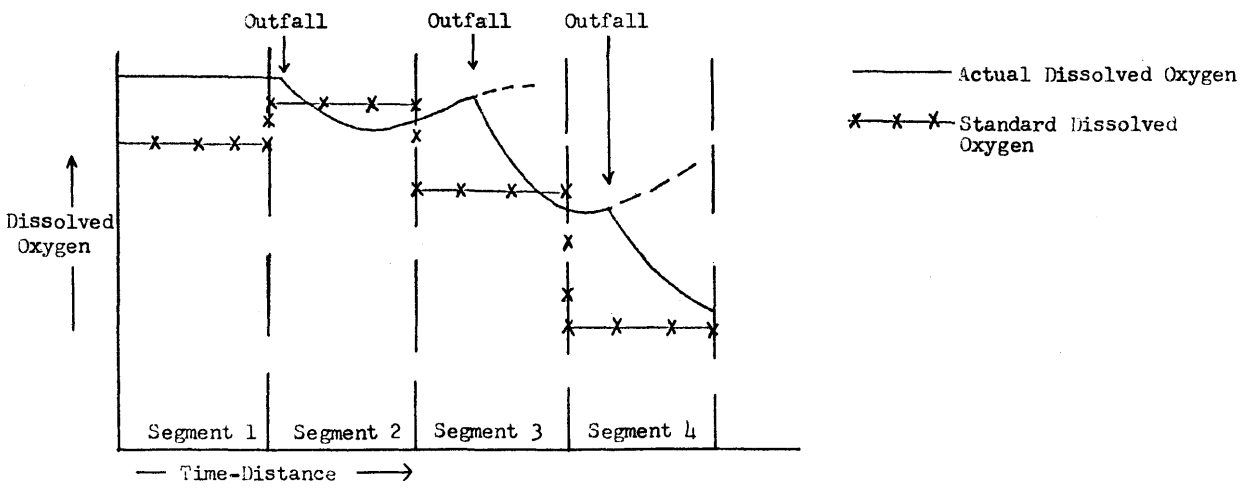


Figure 3. Actual and Standard Dissolved Oxygen Relations.



Urban Regional Water Management Institutions

The preceding sections described the geographic contribution to the design of urban water management institutions. Two components were stressed:

(1) Process transformation -- the production of water from precipitation, including its storage, pretreatment, use, alteration to spent water, posttreatment, discharge into a natural body of water, and subsequent use or non-use.

(2) Spatial patterns -- the geographic locations of the nodes at which the process transformations occur, including the effect of these locations on transformations and distributions.

In the geographic view, the urban regional water system is a network of nodes and links having a real-world spatial geometry. Our understanding of the natural hydrologic cycle suggests that spatial patterns have a pro ound influence on the functioning of the cycle. This is no less true for man-designed water works.

The urban regional water system consists of two linked subsystems: supply and disposal. It follows that three classes of spatial-process relations develop under urbanization -- supply supply, disposal disposal, and supply disposal. The governance of events that occur at the nodes and along the links connecting the subsystems is crucial to the operation of the whole system.

The ability of an institution to operate successfully depends in great measure on the presence of four key ingredients:

(1) target -- what does it work on?

(2) goal -- what are its objectives?

(3) authority -- what constitute acceptable bases for its actions?

(4) structure -- what internal arrangements direct its effort?

The first two, target and goal, have been treated. Little further remains to be said about them except that all the essays in this volume seek the same goal, improved use of water. Target identification is peculiar to the substantive character of the discipline. The importance of geography's target selections has been examined.

Authority and structure must be arranged in ways that permit the institution to operate on the target to move the system toward it. The legal bases of the authority, the specification of the mandate, and the area of jurisdiction are essential. While it is true they tend to be the specialized concern of political science, nevertheless, geographic realities cannot be ignored.

Assuming that the appropriate legal bases exist for the mandate covering the watershed of interest, the question of institutional structure remains. Internal structure is important because of the need to resolve in an equitable manner the conflict of interest over the scarce water resource. Allocational decisions must consider the public interest as well as the contending private interests, some of which may also serve the public.

If the institution is to function effectively it must have access to valid information on which to base allocational decisions. The institutional structure must have regional data on the state of the water system so that it may govern agency relations at subsystem linkage nodes. Information and structure are key elements of a viable urban water management institution. Information will be considered next.

1. *Regional Water Information.* The object of a metropolitan-area water surveillance system is to gather data on events or states in which each bit of information on raw and spent water, effluent, transfers, plant capacity, or demand and supply can be related to every other bit in ways that bear on local and regional management and policy decisions. To attain these objectives a region-wide monitoring network has to be designed into the institutional and management structure. The advantages are apparent: a single uniform pool of information will permit the simulation responses of bodies of water to natural and man-induced hydrologic events; it will facilitate the evaluation of alternative programs; it will reduce the period of time between the recognition of pollution problems and their solutions; and it will facilitate environmental-impact reviews of short- and long-term land and water policy decisions.

A detailed empirical study of the water information system of the New York-New Jersey Metropolitan Region presently operated by a plethora of public and private agencies, revealed a lack of uniform procedures and a high degree of confusion (Carey, Zobler, Greenberg, Hordon, 1972). The result was that the water-information system accumulated vast reservoirs of data of limited regional managerial utility.

The elements of a hydrologic data base to provide inputs into an institution whose responsibilities are long-term water policy formation and short-term allocational decisions are:

1. identification of useful parameters
2. selection of bodies of water
3. selection of effluent sources
4. location of points at which samples are taken
5. frequency of observation
6. reliability of sensing instrumentation used
7. standardization of methods used to analyze samples and scale results
8. recording of data
9. storage and retrieval of data
10. preservation of the systemic character of information.

The last element is particularly important. It insures the preservation of the hydrologic unity of the natural and man-designed water cycles; it also insures the managerial integration of the data assembled to describe subsystem relations. The data on the hydrologic elements would next be interfaced with the political and economic geography to give a picture of the regional activities that influence, through population, employment, and industry, water-use and quality goals, and land uses and waste loadings.

2. *Institutional Structure.* In order to create and carry out regional water policy the internal structure of the managing institution should be sensitive and responsive both to specific groups of water users and disposers and to the diffuse public interest. Regulations governing access to the water resource must be established, subject to the behavioral constraints of the metropolitan hydrologic cycle, partic-

ularly subsystem links. The composition of a regional water agency should regard water users as contenders for a scarce resource, giving representation to the contending parties with appropriate weights to groups whose interests protect vulnerable links.

The uses of metropolitan area bodies of water fall into two conflicting categories: (a) supply -- potable, industrial, fishery, recreational; (b) disposal -- sanitary, industrial, runoff. This dichotomy affects fresh water streams, tidal fresh streams, estuaries, lakes, marshes, reservoirs, and aquifers. As urbanization expands, the conflict intensifies. User groups adopt self-interest strategies. The clean-water-supply group employs three strategies: (a) acquiring new sources, more distant locations or drilling deeper at old sources; (b) raising treatment levels of raw water; or (c) supporting regulatory or preventive measures against disposers.

The spent water disposers employ delaying tactics: (a) encouraging the clean water users to acquire new sources or to pre-treat raw water; (b) seeking to postpone the imposition of penalties or requirements for effluent pre-treatment; or (c) relocating outfalls, sometimes moving plants.

The dilemma is that both user groups have concurrent needs for clean water supply and spent water disposal. Conflict develops because all users draw on the same natural waterways to satisfy their demands and because user decisions are based on short-run, geographically limited criteria. Lined up against both user groups is the more diffuse public interest, whose goal is to maintain the long-term hydrologic integrity of the irreplaceable resource.

In the metropolitan-area water environment, peculiar circumstances cause the externalization of user responsibilities: (a) the water source may be geographically and/or hydrologically separate from the water sink for some users. For these users there is no conflict. Examples are a water system that imports water from outside the region or an industry that draws on ground water; (b) jurisdictional boundaries may be incongruent with the water flows, natural or man-made. This may encourage one political unit to export its effluent treatment costs to another unit, which is bound to assume them as higher pre-treatment costs or foregone uses. (c) The waterway may be viewed as a common property resource. Within communities this attitude encourages users to transfer their costs to the public in the form of untreated effluent, which raises pre-treatment costs of raw water.

Three groups of organizations are identifiable as agencies operating on the water resources of metropolitan areas in the environment of conflict described above. They are:

A. Clean-Water Users

1. individuals
2. private water companies
3. small municipalities or communities
4. large public or quasi-public producers
5. industries
6. commercial and sport fisheries
7. private and public contact recreation sports groups
8. marinas

B. Waste-Water Disposers

1. individuals
2. large sewerage authorities
3. large communities
4. small municipalities and communities
5. industries
6. transport companies

C. Neutral (no directly competitive interest)

1. federal agencies
2. state agencies
3. local agencies
4. interstate compact agencies
5. scientific research groups
6. citizen groups

A recent study of the behavior of these groups in the New York-New Jersey Metropolitan Region showed that the neutral and government agencies "performed" inadequately as guardians of the region's water resources, and, indeed, of their own long-term self-interests (Carey, Zobler, Greenberg, Hordon, 1972). Record-keeping was poor; enforcement was haphazard; sampling was irregular and generally ineffective; coordination of effort by separate agencies was weak; and a regional managerial view was absent. The reliance by health departments on chlorination as a panacea to transform raw water into potable water, for example, tended to encourage the neglect of the quality of the natural waterways. Indeed, it can be said that the crucial transformation for the survival of the regional water system is chlorination at two subsystem nodes, the sewa e plant outfall and the water plant intake.

Recommended Guidelines for the Design of an Urban Water Management Institution

The institutional problem is clear. It is to alter the present formal and informal patterns for allocating water resources that survive as vestiges of an earlier era, or as patchwork adjustments, and to recommend an institutional structure (organization and behavior) better adapted to the hydrologic requirements of urban-metropolitan regions. It is possible that the growing shortage of water may be due as much to our inability to manage the urban hydrologic cycle as it is to the availability of the resource itself (Martin, 1960).

What principles should guide the formation of such an institution? I suggest the following: (a) equitable resolution of the conflict of interests among all water users; (b) regional internalization of all water costs to prevent the escape of responsibility; (c) maintenance of quality and utility of the water resource within the constraints of publicly determined goals; (d) appropriate funding, authority, and staffing to establish structural and non-structural controls under a central direction; (e) representation of all water users on a policy-making board.

Considering the present degraded state of most metropolitan area waterways and the need to improve them, membership on the policy-making board should be weighted in favor of the clean-water users, especially those dependent on intra-regionally produced water, and the neutral groups. The granting of representation on the policy board to all contenders should make the institution a more effective and democratic instrument. The details of the administrative structure and the selection of the tactics to insure

the efficient attainment of regional water quality in an equitable manner for all users are open issues. A variety of methods have been employed abroad and in this country, but none appears completely satisfactory (Kneese and Bower, 1968). The use of organizational theory to understand why regulatory agencies, commercial and industrial users and polluters, and water producers, distributors, and sewage authorities, public and private, display peculiar behavioral patterns should provide valuable information for the design of urban regional water policy boards (Zimmerman, 1972). The problem merits further study.

REFERENCES CITED

Carey, G. W., L. Zobler, M. R. Greenberg, R. M. Hordon.
1972 Urbanization, Water Pollution and Public Policy, Report to the Office of Water Resources Research, USDI, Urban Policy Research Center, Rutgers University.

City of New York.
1970 Annual Report, Board of Water Supply.

Cohen, P., O. L. Franke, B. L. Foxworthy.
1968 An Atlas of Long Island's Water Resources, U.S. Geological Survey and New York State Water Resources Commission, Bulletin 62.

Fuchs, A. W.
1968 The Economic Impact of Drought on Water-Supply Systems in the Passaic River Basin, New Jersey, Department of Agricultural Economics, Rutgers University.

Hardin, G. M.
1968 "The tragedy of the commons," Science 162 (December): 1243-1248.

Interstate Sanitation Commission.
1970 Annual Report.

Kneese, A. V., and B. T. Bower.
1968 Managing Water Quality: Economics, Technology, Institutions, Resources for the Future, The Johns Hopkins Press.

Leopold, L. B.
1968 Hydrology for Urban Land Planning -- A Guidebook on the Hydrologic Effects of Urban Land Use, U.S. Geological Survey Circular, 554.

Lull, H. W., and W. E. Sopper.
1969 "Hydrologic effects from urbanization," USDA Forest Service Research Paper NE-146, Upper Darby, Pennsylvania.

Martin, R. C.
1960 Water for New York, Syracuse University Press, p. 245.

Muller, R. A.
1969 "A water balance evaluation of the effects of urbanization on water yield in metropolitan northeastern New Jersey," appendix H in Benefits from Integrated Water Management in Urban Areas -- The Case of the New York Metropolitan Region, by L. Zobler, G. W. Carey, M. R. Greenberg, R. M. Hordon.

Savini, J., and J. C. Kammerer.
1961 "Urban growth and the water regimen, U.S. Geological Survey Water Supply Paper 1491-A.

Smith, E. T., and A. R. Morris.
1969 "Systems analysis for optimal water quality management," Journal, Water Pollution Control Federation, September.

Smith, E. T.
1970 "Spatial distribution of effluent loads in water quality management," Proceedings, 11th Annual Meeting of the New York-New Jersey Division, Association of American Geographers, Cortland, New York.

Spieker, A. M.
1970 "Water in urban planning, Salt Creek Basin, Illinois," U.S. Geological Survey Water-Supply Paper 2002.

Zimmerman, R.
1972 The Effectiveness of Industrial Water Pollution Control in the New York Metropolitan Region, Doctoral Dissertation, Columbia University, New York, New York.

Zobler, L., G. W. Carey, M. R. Greenberg, R. M. Hordon.
1969 Benefits From Integrated Water Management in Urban Areas -- The Case of the New York Metropolitan Region, Report to the Office of Water Resources Research, USDI, Washington, D. C.

ADDITIONAL REFERENCES

Albertson, M. L., L. S. Tucker, D. C. Taylor, eds.
1971 Treatise on Urban Water Systems, Colorado State University.

Craine, L. E.
1969 Water Management Innovations in England, Resources for the Future, The Johns Hopkins University Press.

Drobny, N. E., ed.
1970 "Dimensions of water management," Proceedings, First Annual Ohio Water Resources Conference.

Kelnhofer, G. J., Jr.
1968 Metropolitan Planning and River Basin Planning: Some Interrelationships, Water Resources Center, Georgia Institute of Technology.

Mack, L. E.
1971 Ground Water Management in Development of a National Policy on Water, National Water Commission, NTINS PB No. 201536.

McPherson, M. B.
1970 Prospects for Metropolitan Water Management, ASCE Urban Water Resources Research Program, sponsored by OWRR.
1971 "Management problems in metropolitan water resource operations," ASCE Urban Water Resources Research Program, Tech. Memo No. 14.

Raven-Hansen, P.
1969 Water and the Cities: Contemporary Urban Water Water Resource and Related Land Planning, ABT Associates, sponsored by OWRR, U.S. Clearinghouse Publ. No. PB 184699.

Sheaffer, J. R., S. A. Starr, G. Davis, A. Richmond.
1969 Metropolitan Water Resource Management, Center for Urban Studies, University of Chicago.

Spieker, A. M.
1970 "Water in urban planning, Salt Creek Basin, Illinois," U.S. Geological Survey Water-Supply Paper 2002, 1970.

Urban Systems Research and Engineering, Inc.
1971 Metropolitan Water Management -- Case Studies and National Policy Implications, sponsored by National Water Commission, NTINS Publ. No. PB 199493.

Chapter Nine
Institutions and Water Management: A Systems View

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This paper approaches *institutions* and *urban water management* from a systems perspective. Accordingly, it is important to examine each of these terms for the purpose of clarifying its meaning in this context. In a given urban area, the specific responsibilities of urban water management may include recreation, navigation, production of electrical energy, and disposal of excess heat. The list could be continued. But the crucial responsibilities of urban water management, and thus the scope of this paper, are limited to three: the provision of potable water; the treatment of waste water, including the collection of storm runoff; and the minimizing of loss of life and damage to property caused by floods. The term *urban water management* here refers to those decisions and actions necessary to provide dependable potable water service to a variety of consumers -- residential, commercial, and industrial -- within an urban area, to subsequently collect and treat waste water generated by these elements, and to deal with flood damage from storm water runoff and river overflows. The importance of the latter service is illustrated by Tropical Storm Agnes, which in June, 1972, cost more than one hundred lives and a billion dollars in property damage. The human stress which accompanied the destruction and subsequent clean-up task was increased by the sudden failure of water-supply and waste-water-treatment facilities in the storm area, which posed a significant threat of waterborne diseases.

The following definitions suggest the scope and range of meanings for the term institution:

(1) The action of instituting or establishing; foundation;

(2) The giving of *form* or *order* to a thing;

(3) An *established* law, *custom*, *usage*, *practice*, organization or other element in the political or social life of a people;

(4) An establishment, *organization*, or association instituted for the promotion of some object -- especially one of public utility; (italics added) (Oxford Universal Dictionary, 1955).

If we combine parts of meanings 2, 3, and 4 above with our definition of urban water management, we may conclude that the term *institutions of urban water management* means the established patterns which have evolved to provide the basic services of water supply, wastewater treatment, and flood control in urban areas together with whatever additional activities are applicable in a specific urban location.

The systems approach to the study of a problem is primarily to investigate the *relationships* between elements of the problem rather than to analyze the structure of individual elements. Thus we must concern ourselves with interrelated components and their function in order to describe the nature of urban water management. Our objective is to apply a general systems theory to classify the components of an activity by their interrelationships and to derive the "laws" or typical patterns of behavior for the different classes of activities considered (Rapoport, 1968: 30). This paper will present a theoretical model of a system of urban water management which specifies the role of institutions. The final portion of the paper applies the theoretical system to a specific problem in urban water management.

System Model

The thesis of this paper is that the system model applicable to urban water management is a model which treats urban water management as a complex adaptive subsystem of society (Buckley, 490). Since water management decisions must be made by identifying and evaluating alternatives before finally discarding or implementing them, they form a complex activity which is continually changing in response to the needs of an urban situation. Urban water management is a subsystem insofar as it is but one part of the total urban society. Accordingly, an adaptive system model for urban water management has the following components:

(1) *Process*

(2) *Tension*

(3) *Interaction Matrix.*

The term *process* stands for the interactions and interrelationships between organizations, groups, agencies, individuals, and special interests desiring to affect the course of urban water management. Linkages between these diverse units may be characterized by competition, conflict, or cooperation. The study of process must include the goals as well as the plans of the several units coming together for the purpose of providing urban water needs (Van Dyke, 1968:23). Process includes federal agencies, which seek to implement national objectives. State agencies may be involved as well, both to provide matching state funds in the case of waste-water-treatment facilities and to assure that urban water systems (water-supply and waste-water treatment) meet necessary health and environmental requirements. Regional agencies (planning and operational) are involved more and more in comprehensive water management because urban areas typically extend beyond and across previously established local political boundaries. Both public and private local interests are actively engaged in process when they seek to provide water services which benefit local interests.

Tension is a driving force in all complex adaptive systems. It represents the difference between the present state of the system and its goal for the future. For example, the desire for "regional" waste-water treatment systems represents a driving force to alter both the physical arrangements of treatment sys-

tems serving local political units as well as the administrative structure associated with such systems. In general, tension results when one or more of the units involved in the process interaction arrives at new goals or alters its goals, and the new or altered goals are acceptable to all parties. It is clear that tension may also result when units desire to preserve or maintain existing structure or arrangements in the face of changing conditions. The rapid growth and extension of urban areas since the end of World War II has resulted in the fragmentation of the political authority responsible for providing basic water services. Established authorities tend to defend their territorial prerogatives in the provision of basic water services and to resist the transfer of such power to larger regional groups. The deterioration of water quality adjacent to or downstream from urban regions may serve as an agent for change, thus contributing to tension. People who must use the water whose quality has been adversely altered by upstream activities become vocal advocates for improved handling of upstream wastes in order to improve downstream quality.

The *interaction matrix* is the status of the system -- the net effect of the interaction of the units at any given point in time. According to the situation and the geographical location, the interaction matrix may be stable or volatile (tension in the system may drive change rapidly; the system may experience a period of intense evolutionary alteration which may be followed by a plateau of relative system stability). The interaction matrix for waste-water treatment in this country has been volatile since the enactment of the Water Quality Act of 1965. This legislation formally introduced the concept of government-established criteria for water quality and authorized an increase in their number. Federal legislation now pending may serve to continue the rapid system changes by specifying effluent limits and waste-water treatment technology.

The systems model requires both an identification of all organizations concerned with urban water management and a representation of the dynamics of interactions between organizations and between the organizations and the environment. System definition requires that boundaries within which organizational activity will take place be defined. Activities and actions external to the system boundaries may be classified as outside factors which may, however, cross system boundaries. An *institution* is the established activity which has evolved to provide the desired goal. An institution is a necessary condition for the systems model; however, an institution is not a sufficient condition for the systems model. In essence, the existence of an institution implies static conditions in either structure or process. In structure, an institution of urban water management is an established organization designed to provide one or more basic urban water services. In process, an institution is an established practice, custom, or usage for the provision of the desired service. The model which views the provision of basic water services as a complex adaptive system recognizes the existence of established institution structure and usage. Furthermore, this model incorporates the elements of tension, interaction, output, and feedback cycles as realistic and necessary components for the provision of water services within specific urban areas. Figure 1 provides a graphic representation of the complex adaptive political model for urban areas.

The systems model shown in this figure is derived from the theoretical work of David Easton. Easton offered the following particular insights into the nature of a systems approach to political analysis:

> Political interactions in a society constitute a system of behavior. The political system is a product of its environment. The political system is an open system in that it continuously receives information from its environment. The political system both responds and adapts as a result of the inputs received (1966:143).

Urban water management constitutes a particular political system operative in the overall framework of the total urban political model shown in Figure 1. Interaction matrices as defined for this paper occur in at least three points of the political model -- first in the input process, which serves to articulate demands from and support by the public; second, in the structure portion where the authoritative interactions which result in binding decisions take place; and third, in the evaluation of the outputs by the structure portion of the system. Tension is most dominant in the input stage of the political model where the differences between desired goals and present status are articulated. Traditionally the specification of urban water management goals has been the domain of specialized officials and bureaucracies, with only slight contributions from specialized interest groups. An exception is the unique situation; for example, an arid or semi-arid setting where the spectre of water shortage mobilizes public action. Process occurs throughout the model as the diverse units bargain, negotiate, communicate, and attempt to influence outcomes congruent with their own goals and objectives.

Given this model of an urban political system and given the functions of process, tension, and interaction matrices, the function of institutional structures and institutional processes in urban water management may be specified. The spatial extension of urban areas beyond established political boundaries has increased the number of inputs which need to be evaluated in order to achieve authoritative interactions and produce decision outcomes for urban water management. Furthermore, the environmental concerns expressed by a variety of special-interest groups will -- if sustained -- contribute additional inputs. Because of the complexity of the technological, financial, and administrative problems associated with providing the basic services of water management in metropolitan areas, institutional structure and institutional processes which were successful for urban water management in the past need to be stressed. Increasing federal involvement in providing financial resources and enforcement procedures, and in setting standards -- particularly for wastewater discharges -- increases the pressure upon the urban political system to seek solutions which will satisfy the host of new inputs coming into the system. Often, the established or traditional methods of providing essential water management services break down in the attempt to extend them to the enlarged area. Therefore, at present urban water management is in a state of dynamic adaptive process aimed at establishing innovative institutional structures and processes to satisfy these recently articulated demands. Until the procedures for responding to these pressures are "institutionalized" one should anticipate a continuing process of tension and conflict in urban water management.

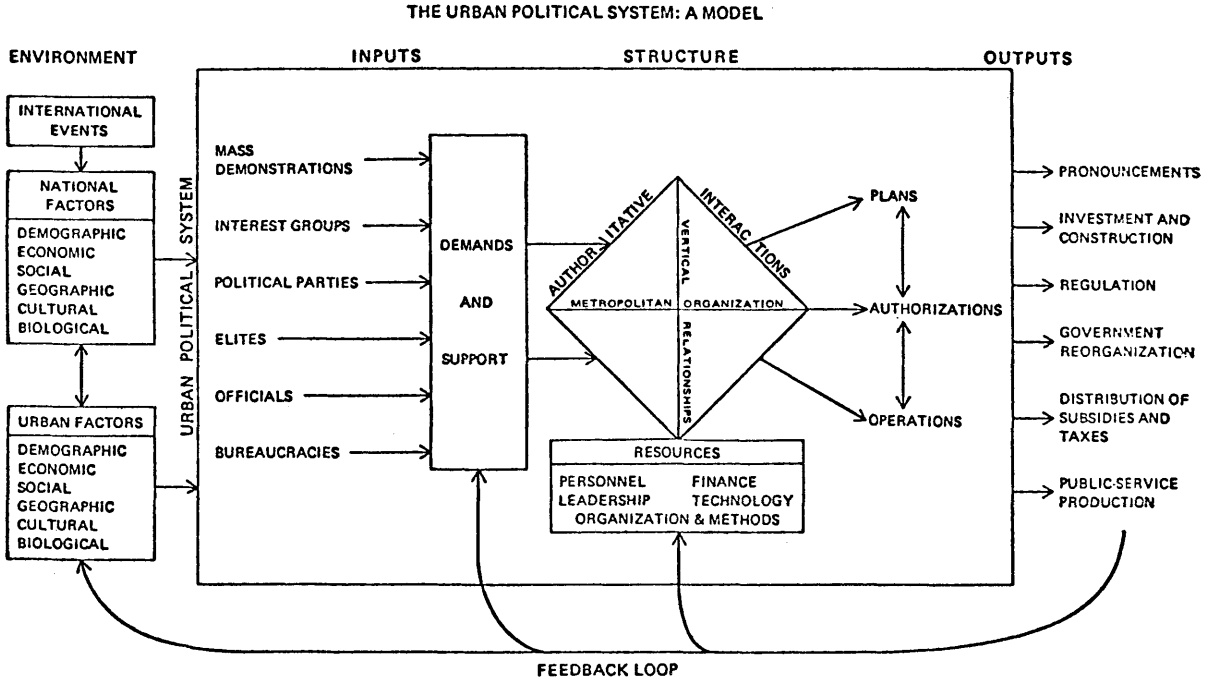

Figure 1 (Walsh, 1969:324)

Application: Waste-water Management -- Urban Detroit Region

As an example of the systems model developed in this paper, let us consider the situation of waste-water management in Southeastern Michigan. In this region are seven major river basins draining an area of over 5300 square miles. The detroit metropolitan area is the hub of Southeastern Michigan; within it, the outlying urban centers of Monroe, Ann Arbor-Ypsilanti, Pontiac, and Port Huron form an arc which swings from the south to the extreme northeast. Within this arc are a variety of highly urbanized, suburban, and agricultural areas. The total population is approximately 4,500,000 (Corps of Engineers, 1971). Detroit is located on the Detroit River -- a large river with a mean flow of approximately 180,000 cubic feet per second which empties into Lake Erie.

In November 1968, the citizens of Michigan voted to authorize the State of Michigan to issue general obligation bonds with a total value of $335 million for the purpose of providing state funds to assist units of governments in upgrading and extending waste-water treatment facilities. A significant political struggle is taking place within the state over the techniques to be used in treatment of waste water in Southeastern Michigan. The issue is whether or not the limited state bond funds should be allocated to support large regional interceptor sewers with a very limited number of massive sewage treatment plants located along the shores of the Detroit River and Lake Erie *or* to encourage expansion and upgrading of the treatment capability of a larger number of plants located at strategic points throughout the service area. The latter course of action would require extremely high levels of waste-water treatment and would require the improvement of certain existing sewage treatment plants in the interior of the region as well as along the shores of the Detroit River and Lake Erie.

The issue set out above shows the working of a complex adaptive political system in the area of urban water management. In December 1961 the Governor of Michigan, John B. Swainson, requested that the Secretary of Health, Education and Welfare call a preliminary conference to determine the need for a detailed investigation of the pollution of Lake St. Clair, the Detroit River, Lake Erie, and their tributaries within the State of Michigan. This input by Governor Swainson initiated action which produced two studies on the problem of waste-water disposal for Detroit and Southeastern Michigan. One was a three-year investigation undertaken by the U.S. Public Health Service, which

reported its findings in 1965. Also, after the Public Health Service investigation was begun, county government officials commissioned a special study, in two parts, by the National Sanitation Foundation (NSF) of (1) sewage disposal problems and of (2) administrative affairs related to environmental problems in the Detroit Metropolitan Region. The NSF reports were published in late 1964, six months before the report of the U.S. Public Health Service (NSF, 1964). These NSF reports appear to have had a far-reaching and significant impact on water-pollution-control planning in Southeastern Michigan. The NSF reports anticipated certain possible outcomes of the completion of the Public Health Service study. With prudent qualifications, the NSF reports found that the existing (primary) treatment facilities (including combined storm and sanitary sewers) provided by the Detroit Water Service and the Wayne County Board of Road Commissioners would be sufficient "for some time to come." Expansion, when necessary, should follow the established concept of primary treatment at large-capacity plants located along the Detroit River and Lake Erie, with interceptor sewers collecting the wastes for treatment at these lakeshore facilities. The NSF analysis found no justification for higher orders of treatment of wastes from the Detroit Region "in order to prevent an aging process which will undoubtedly continue in Lake Erie, but whose manifestations are still minor" (NSF, 1964a). The NSF study recommended the geographical expansion of the Detroit Water Service, as need required, to include sewage interceptors and lakeshore/riverfront disposal facilities for the entire metropolitan area.

The Public Health Service Report (April, 1965), and its subsequent review by the Water Resources Commission of the State of Michigan, identified the City of Detroit as a major source of pollution. A public hearing in June, 1965 focused the public's attention upon the obvious deterioration of the Michigan waters of Lake Erie and pinpointed the source of this condition as the lack of satisfactory sewage and industrial waste treatment provided by the City of Detroit.

> The City of Detroit which daily pours 540 million gallons of partly treated sewage into Lake Erie's main tributary expressed flat opposition to a federal proposal to institute "secondary" treatment of the sort employed by upward of 50% of the nation's municipalities. The reasons cited were lack of "data" and "nobody could tell" how much the additional processing would reduce the severe pollution in the Detroit River (New York Times, 1965:18).

This 1965 position taken by the City of Detroit derived from the findings of the NSF study. Furthermore, the NSF investigation contained an engineering analysis which assumed that the effectiveness of waste-water treatment would be limited and that sewage treatment technology would not be improved beyond a certain point. Consequently, as the population of the Detroit Metropolitan Region expanded, the increased sewage land would overload the existing assimilative capacity of the small rivers draining the Metropolitan area. As a result, the perceived technical solution would be to collect the wastes from throughout the region via interceptor sewers and transmit them to the Detroit River/Lake Erie shoreline where the consistently high volume flow would be utilized to dilute and disperse the partially treated sewage into Lake Erie. However, advanced techniques of waste-water treatment have been developed which can produce high quality effluents from waste-treatment plants (Weber, Hopkins, and Bloom, 1970:83).

Against this background, more recent developments have taken place which emphasize the role of institutional structure, institutional process, tension, interaction, and evaluation in the urban political system attempting to manage waste-water treatment for Southeastern Michigan. As previously indicated, the basic issue is one of choice between investment in high-order treatment facilities located in the interior, *or* massive transportation networks to deliver the waste for partial treatment and dilution into Lake Erie. During the 1970-1972 time frame, the state first approved the massive interceptor, then exempted certain communities from participating, and finally adopted a plan which allows certain communities to upgrade and expand their treatment plants while requiring others to phase out their treatment plants and place their waste-water into the large interceptor sewer. In terms of the systems model, the unfolding of the events in Southeastern Michigan can be viewed as a series of successive partial passes through the flow model shown in Figure 1. The feedback loop in this model should be modified with feedback occurring at the input stage, the structure stage, and the output stage. Tension or stress in the system has resulted from opposition to the interceptor sewer approach by communities such as Warren, Pontiac, Ann Arbor, and Ypsilanti who have investments in waste-water-treatment facilities and who view the increased costs as a double penalty -- because the communities who have taken steps to treat waste-water are not fully reimbursed for outstanding bonds and because citizens who participate also have to subsidize those communities who have failed to take action in the past. The strong institutional factor operative in this case is the commitment to the massive regional interceptors along lakeshore or riverfronts. This solution has been embraced by certain officials and bureaucracies and resisted by communities with ongoing facilities. The need to recruit support for coalitions supporting either the massive interceptor plan or the upgrading of local facilities plan has modified the positions of certain key units in the model. For example, in contrast to past policy, Ann Arbor has expressed a willingness to extend service to contiguous areas without annexation. Also, the Detroit Metropolitan Water Service appears to have relaxed its previous stand that any new lakeshore treatment plants be under the control of its organization. Advocates have also adopted techniques to recruit support from external interest groups. The Wayne County Board of Road Commissioners has sent letters to elected state and federal officials which summarized their arguments for the Interceptor Plan. The City of Ann Arbor has distributed information packets which present arguments against the Interceptor to shoreline municipalities on Lake Erie. Following requests from local communities and Congressmen, the Environmental Protection Agency has agreed to prepare an environmental impact statement upon the state-approved interceptor sewer prior to final federal approval of the current interceptor plan.

Waste-water management in Southeastern Michigan illustrates the processes involved in contemporary urban water management. The inputs have increased as local, regional, state, and federal participants become involved. The new executive agreement between Canada and the United States regarding pollution control in the Great Lakes adds an international component, the impact of which is not yet clear. Technological progress offers the decision-makers further alternatives for problem solution; however institutionalized structure and process act to direct choices towards exten-

sions of past practice rather than towards innovation. The tensions currently observed in this urban political system for water management should be reduced as new values, processes, and procedures become established or institutionalized. However, one may expect a continuing process of stress and adaptation resulting from new knowledge about providing these essential water services to the urban area. Institutional factors thus play a double role: that of stability and that of change. Institutional structure and processes enable the task to be accomplished, but these same structures and processes may serve to restrict necessary change and evaluation, thus serving to stimulate tension and to produce adaptive responses.

REFERENCES CITED

Buckley, Walter (ed.).
1968 "Society as a complex adaptive system," in Modern Systems Research for the Behavioral Scientist. Chicago: Aldine.

Corps of Engineers.
1971 "Alternatives for managing wastewater for Southeastern Michigan," Summary Report, Detroit District (Mimeo).

Easton, David (ed.).
1966 "Categories for the systems analysis of politics," in Varieties of Political Theory. Englewood Cliffs: Prentice-Hall.

National Sanitation Foundation.
1964a "A report on sewage disposal problems," Ann Arbor (Mimeo).
1964b "Report on metropolitan environmental study -- sewage and drainage problems -- administrative affairs," Ann Arbor (Mimeo).

The New York Times.
1965

The Oxford Universal Dictionary.
1955 Third edition, Oxford Press.

Rapoport, Anatol.
1968 "Forward," in Modern Systems Research for the Behavioral Scientist, Walter Buckley, ed. Chicago: Aldine.

Van Dyke, Veron.
1968 "Process and policy as focal concepts in political research," in Political Science and Public Policy, Austin Ranney, ed. Chicago: Markham.

Weber, W. J., Jr., C. H. Hopkins, and R. Bloom, Jr.
1970 "Physico-chemical treatment of wastewater," Journal of Water Pollution Control Federation 42.

Appendices

A. Condensation of "Institutions for Managing Lakes and Bays," by Lyle E. Craine from 11 *Natural Resources Journal*, 1971, pp. 519-546.

B. Condensation of *Institutional Arrangements for the Great Lakes: Final Report to the Great Lakes Basin Commission*, by Lyle E. Craine, March 15, 1972 (Mimeo).

C. Biographical Notes on essay authors.

Appendix A
Institutions For Managing Lakes and Bays*

by Lyle E. Craine**

Within the past decade the nation has experienced a growing consensus of dissatisfaction with the development and use of its lakes, bays, and estuaries. Particularly in those lakes and bays with mounting pollution, criticisms often focus on institutional inadequacies. This article is based upon an ongoing exploration of the institutional aspects of managing lakes and bays. The presentation here will emphasize the factors involved in designing a lake/bay agency, including the scope of an agency's powers, its geographic jurisdiction, the interactions between it and other agencies, and the organizational form of its governing body.

Lakes and bays represent a special type of resource complex, valuable in their own right and in terms of the environment as a whole. Their perceived value often exceeds the sum that might be derived separately from their water, land, and air components. The complex of uses to which lakes and bays are subject tend to generate special problems in water quality and a set of problems concerning shoreline usages. A review of these problems suggests that the public concern about lakes and bays arises from three factors: (1) spillover effects from specific kinds of developments and uses; (2) perceived discrimination in the distribution of benefits or costs; and (3) loss of faith in the ability of existing institutions to deal with spillovers and distributional questions in ways that satisfy the public interest.

Spillovers is an operationally useful way to characterize the social-economic effects of the pollution problems. Discrimination in the distribution of benefits and costs arises when any identifiable class of citizens feels it is deprived of opportunities to which its members have rights. Loss of institutional credibility is perhaps the most fundamental of the three causes for public concern. Thus the institutional question is central and the one on which this study focuses.

As used here, "institutions" and "institutional arrangements" refer to a definable system of public decision-making, one that includes specific organizational entities and governmental jurisdictions, but transcends conventional emphasis upon definition of agency structure, per se. In addition to being concerned with component organizational entities, the term "institutions" suggests special attention to the configurations of relationships (1) established by law between individuals and government; (2) involved in economic transactions among individuals and groups; (3) developed to articulate legal, financial and administrative relations among public agencies; and (4) motivated by social-psychological stimuli among groups and individuals. Specific relationships falling in any or all of these four categories, constrained and shaped by the natural and social environment, weave a web which describes the institutional system for decision-making. Thus institutional studies focus on the linkages which tie authority and action centers together into a public decision-making system which is responsive to the environment within which it must operate.

Clearly, few such decision-making systems can now be recognized. Therefore, the proposed definition is to some degree like a "model." Its use for prescribing institutional reforms by necessity introduces normative considerations. This paper will first suggest a framework for institutional analysis and design, and then explore the factors involved in designing a lake/bay agency.

A Framework for Institutional Analysis and Design

If the purpose of institutional arrangements is to provide a system for making public decisions, a framework for institutional analysis and design must consider three primary factors: (1) the nature of the public decision expected from the institutional system; (2) the institutional environment and its capacity to make the kinds of public decisions expected; and (3) the institutional design process.

1. *The Nature of Lake/Bay Decisions.* The nature of the decisions required may be described in two ways: in terms of the problems which appear to generate dissatisfactions with present development and use of lakes and bays; and in terms of a concept of the job that institutions are expected to perform.

Public concern about lakes and bays arises from dissatisfactions stemming from spillover effects of present activities, and those stemming from alleged discrimination in the distribution of social-economic benefits. Therefore, institutional reform must have as its goal a decision-making capability better able to deal simultaneously with efficiency and distributional consequences of development and use actions.

Institutional reform also requires a positive concept of the job to be done -- one that can consider the full range of development and use potentials in terms relevant to today's values and priorities. For this purpose, it is proposed that the task be conceived as one of producing a mixture of public goods

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and services from the resources of a lake/bay environment. This views the task as a public production function. Therefore, the institutional question is how to organize such a production function -- a process by which the various agents of society convert resources into socially desirable goods and services according to society's preferences and with due consideration to the efficiency and equity consequences. A formulation of the job in these terms invites attention to the adequacy of institutional devices for (1) adequately expressing social preferences for potential outputs; (2) adequately expressing social costs involved in the production and consumption process; and (3) bringing expressions of preferences and costs into confrontation before the appropriate decision-making authorities.

2. *The Institutional Environment.* The existing institutional environment relevant to the production of public goods and services from lakes and bays involves two interdependent decision systems: the private economic market and the governmental system. Although there is a strong predilection to leave the production of goods and services from natural resources to private enterprise, the resource complex of the lake/bay possess conditions that do not satisfy the requirements of efficient market allocations. Three such conditions tend to induce market failures in the production of goods and services from lakes and bays.

The first is the fact that many aspects of a lake/bay environment possess common property characteristics. Where such common-property characteristics dominate the inputs of production, major public interventions in market incentives appear necessary if the inefficiencies of laissez-faire are to be avoided. The second condition is the fact that many product and service outputs are indivisible and cannot be divided into units which may be withheld from those who are not willing to pay and delivered to those who do pay. One cannot put property boundaries around air and water. A third condition which encourages market failures is the presence of complex technical and spatial interdependencies that generate spillover effects wherever one individual or corporation independently takes action affecting the environment. Institutional improvements should seek various devices that will induce the decision system to seek an understanding of the net social consequences of potential spillover effects.

Given the present institutional posture and the natural, social, and economic imperatives of environmental resources, it is not surprising that our existing institutions fail to meet performance standards required by today's lake/bay problems. Building institutional capability will require further intervention by government in what has essentially been laissez-faire, in the public as well as in the private sector.

3. *The Institutional Design Process.* The present "consensus of dissatisfaction" includes demands for changes in the extent and manner of governmental intervention. New forms of intervention, if they are to result in improved lake/bay decisions, should compensate (1) for lack of private enterprise's capacity to deal with certain environmental problems, and (2) for the fragmentation of public authorities, which are relevant to lake/bay management.

The latter is often the result of separate organizations to (1) generate and disseminate information relevant to the development of a lake/bay, (2) conduct surveys and prepare plans for developing and controlling the environment in a lake/bay region, (3) regulate the development and use of the lake/bay resources, (4) require transfer payments among development and use agents based upon a benefit or damage quid pro quo, and (5) produce, by publically managed enterprise, specific environmental benefits.

Not all lakes and bays require a management agency in which all types of intervention are exercised by a regional lake/bay agency. Many may indicate a lake/bay agency of more limited powers, sharing its decision responsibilities in varying degrees with established agencies and jurisdictions of general government.

The design process as conceived herein, deals with sets of interactions among three primary institutional determinants and four institutional elements. (See Figure 1.) The chief determinant is made up of the intervention objectives. These objectives, however, are conditioned by the other two determinants -- environmental conditions of the lake/bay, and the political climate reflecting the public perceptions of those problems. Taken together these three determine the four institutional elements.

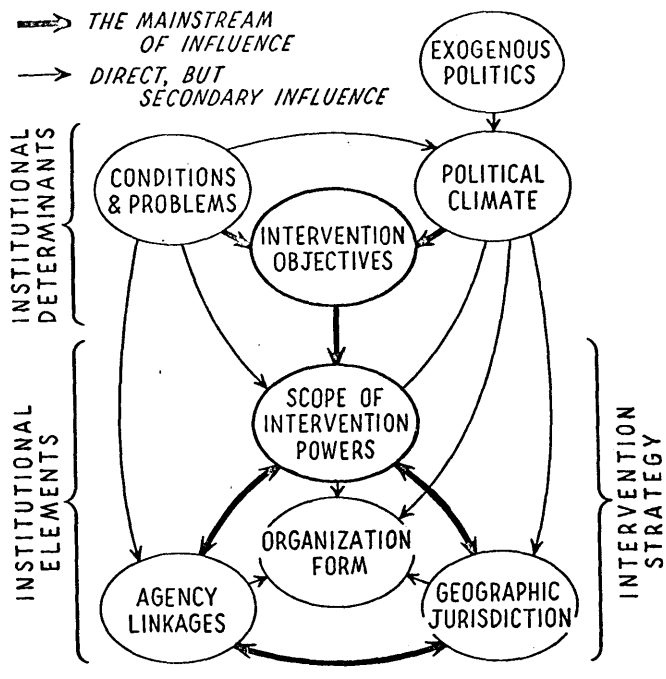

FIGURE 1
Process of Designing Institutional Arrangements for Lakes and Bays

The four institutional elements consist of (1) the scope of intervention powers, (2) agency linkages, (3) geographical jurisdiction, and (4) organizational form. The ultimate decisions concerning these elements result in what is herein called an intervention strategy. Choosing appropriate intervention strategies in the basic decision which confronts the political process relevant to development and use of lakes and bays.

Designing a Lake/Bay Agency

The framework for institutional analysis and design recognizes that a wide range in intervention strategies may be appropriate, depending upon environmental and political variables in the particular lake or bay under consideration. The remainder of the paper will explore the nature of interactions among the determinants and elements of intervention strategies in designing a strategy for a lake or bay.

1. *Determinants of Strategy and Design.*

a. Environmental conditions and Problems

Of the three determinants, environmental conditions and problems are basic. A first step in the process of designing an institutional strategy for a specific environment, is therefore, a careful analysis of the resource attributes and problems associated with their development and use. This analysis, in turn, may alter the public's perception and as a result, affect the political climate.

b. Intervention Objectives

With analysis of the problems of a lake or bay, it is possible to propose specific intervention objectives in terms relevant to the basic criteria for institutional performance, namely efficient use of the resources and equitable distribution of benefits and costs associated with their development and use. This is illustrated by the "wetlands" issue which emerges frequently in bay management.

The wetland problem stems from the fact that filling to produce shore front property, now in great demand in the real estate market, is more profitable to private entrepreneurs than the production of other potential benefits of wetlands, such as habitat aquatic life, wild fowl, and scenic amenities. The "wetland" issue has both efficiency and distributional consequences, which need to be considered in the formation of the intervention objectives.

c. The Political Climate

Although specific prescriptions of intervention objectives may be formulated, they may not be viable under the contemporary structure of politics. The political climate, therefore, is a third major determinant of intervention strategy and institutional design. Seldom will the relevant political climate be limited by any regional demarcation for lake/bay management. Local, state, regional, and national politics interplay upon any specific lake/bay situation. While the political factor may have its primary influence upon the intervention strategies, it may also determine the scope of intervention powers and the organizational form of a new agency.

2. *Elements of Institutional Design.*

a. Scope of Intervention Powers

Just as the choice of intervention objectives is the focus of the three determinants, so, too, the selection of intervention powers to be delegated to the lake/bay agency may be the primary institutional element in an intervention strategy. Thus, analytically, the prescription of intervention objectives and the determination of the powers to be given the lake/bay agency are the first steps in developing institutional arrangements for a lake or bay.

The kind and scope of intervention powers given to a regional management agency range over a wide spectrum. Two criteria are critical in determining the extent of the delegated powers. The first is agency motivation, and the second is the need for integration and flexibility of decision-making in the regional lake/bay situation. Motivational incentives of any agency are of prime importance as to whether authority granted to an agency is actually used. For example, the failure of many states to use effectively their regulatory powers over pollution may stem from built-in political incentives to show more concern for the interests of the generator of pollution than for those who suffer the consequences. In some instances motivation now lacking in an established agency may be obtained by transferring the authority or some aspect of it to a lake/bay agency.

The second criterion for determining the scope of intervention powers is the need for integration and management flexibility, requiring delegating a significant part of intervention powers to a regional agency. How many such powers are delegated depends on a balance between the need for functional centralization of powers by the state or national government and the need for a delegation of some of those powers to a regional agency for greater efficiency and distribution of products from the natural resources of the lake/bay.

b. Geographic Jurisdiction

The geographical jurisdiction for lake/bay management may influence, and in turn be affected by, the scope of management powers which a lake/bay agency may appropriately exercise. The boundary question has proven difficult in most regional planning and management efforts. This is largely due to the fundamental geographical disconformity among regions demarcated by (1) the natural-technological systems, (2) social-economic systems, and (3) governmental systems.

In a great number of instances, the natural-technological system serves a good point of departure for considering the factors affecting the geographical jurisdiction of a lake/bay agency. In this frame of reference, spill-over effects stemming from physical interdependencies are the major consideration in delineating agency boundaries. Agency boundaries delineated by means of the natural-technological system are apt to be resource oriented. A different type of agency might have its boundaries delineated by the people it serves with a given resource, such as parks and recreation for a given area. This type of agency is apt to be service-oriented. Although differentiation of the two kinds of agencies is an idealized formulation of the problem solution, the distinction between the essential functions implied by resource management and those implied by providing a service should be valuable in

considering both the geographical jurisdiction, powers, and interagency linkages of a lake/bay agency.

c. Interagency Linkages

A primary detminant of linkage requirements is the degree and manner in which intervention powers are assigned to a regional agency. Accordingly, the set of linkages appropriate for a lake/bay agency may differ from place to place and for different stages of development. In situations where there are intense environmental pressures, there is likely to be a large delegation of intervention powers to the lake/bay agency. In this case linkages will consist of (1) the constraints under which the lake/bay agency may take action and (2) the extent to which actions taken by a lake/bay agency are constraints upon other decision centers.

In situations calling for limited delegation of powers to the lake/bay agency, quite a different set of linkages is suggested. In this situation, it may be presumed that initiation of action, regulation, funding, and direct action is likely to be dispersed among different agencies. The imperative, therefore, is to prescribe linkages that make it possible for a lake/bay agency to impose constraints in order to bring about a *system* of interagency linkages designed to encourage the agencies to play complementary, instead of conflicting, roles.

d. Organizational Form

Regardless of the scope of powers delegated to it, the agency must give expression to regional interests in both allocation of resources and distribution of benefits. Since it must also have the capacity to reconcile diverse interests, the nature and method of representation for such an agency becomes paramount.

One method of representation might be thought of as a "joint body." Here the agency would be governed by representatives of relevant jurisdictions. A "joint body" will sense its political responsibility through established political-administrative channels. Accordingly, existing power structures would feel less threatened by the creation of the agency; however, such a method of representation would likely make the agency less innovative in dealing with tough problems.

An alternative method of representation might be through a more direct selection of the representatives by the public at large. This might be accomplished by better representation rules for governmental units. However, this may not be extensive enough to redress the balance between the special interests and those advocating priorities of public recreation and pollution-free air and water. Another way to accomplish better representation is through the formation of a governing board directly elected by the people. While this may be fought by those opposing the proliferation of units of special government, this should not rule out serious consideration of this form of representation.

Summary and Conclusions

From exploring the process of designing a lake/bay agency several preliminary conclusions or observations may be noted. First, it becomes evident early in the study that there is no one right institutional pattern for managing lakes and bays. This perception was reinforced again and again in the process of thinking through the framework for institutional analysis and design. Rather than *an* organization or *a* pattern of institutional arrangements, the appropriate institutional response will vary from situation to situation. Accordingly, the study turned to those factors which were institutional determinants and traced their relationships to the resulting institutional elements. The study also uncovered many other areas where further research must be undertaken to provide a better understanding of the role of institutional needs for lake/bay problems.

Appendix B
Institutional Arrangement for the Great Lakes: Final Report to the Great Lakes Basin Commission*

by Lyle E. Craine**

Part I. Introduction

Public concern about the Great Lakes is often expressed by a plea for a Great Lakes Management Agency. It became increasingly clear as this study progressed that a Basin "management agency"[1] is neither a primary need nor, in fact, appropriate for the Great Lakes Basin as a whole. This conclusion is simply stated, but its supporting documentation is complex.

Guidelines for the Study. In order to avoid misunderstandings, the following assumptions and definitions are given:

1. The term "water resource management," is used in a very specific sense; and it is distinguished from water resource development and/or conservation on the one hand, and from water policy and planning on the other. "Management" implies a flexibility of decision-making regarding the use and development of a hydrologic unit. The call for institutional arrangements to manage the Great Lakes is a call for some kind of Great Lakes agency with capability of exercising a flexible manager-like direction of the various governmental powers affecting the use and development of the water and related land resources of the Great Lakes Basin as a whole.

2. The term "regional resource management" is used to designate comprehensive (water and related land) resource management within subareas of the Basin. In this study "regional resource management" will commonly refer to management of "problem systems."

3. *"Institutional arrangements" is distinguished from concern about organizations and agencies by its emphasis upon the interactions among agencies, laws, political electorates, governmental procedures, and informal behavior patterns.* (Emphasis added.)

4. To be effective, a study of institutional arrangements must seek to understand the unique factors of a given situation so that an institutional system can be designed for a given locale.

5. A rational proposal for institutional change should be based upon a demonstrated need for actions which existing institutions cannot or do not provide.

Part II. The Need for Institutional Changes

The point of departure for this study is the fundamental question: What is *not* being done that *should* be done? This focus was chosen with the thought that: If we can be more specific about what needs to be done, we can be more confident in identifying institutional arrangements.

Deficiencies of Existing Institutional Arrangements. Basin management is in part defined by positing a set of legal-administrative powers relevant to managing basin resources. The following functions were considered as constituting the main structure of governmental involvement in basin management:

1. Development and dissemination of information
2. Technical assistance
3. Financial incentives
4. Legal regulation of land and water use
5. Project development and operation
6. Integration of resource development systems in the Basin.

In the appraisal of existing agency programs, two exceptionally important insights were gained. First, it became clear that the idea of "basin management" was too limited a concept to reflect the realities in the Great Lakes Basin. The Great Lakes Basin is simply too large and its problems are too diverse for an agency to exercise a manager's type of "flexible direction." Accordingly, if there is a reason for a Great Lakes agency, it must be expressed in terms other than those associated with basin management as defined.

The second insight was that few deficiencies could be clearly spotted *except* with respect to function 6 above. In the assessment of the existing Great Lakes agencies, none met the need for integration of public authorities relating to resource use and development. The Great Lakes Commission has comprehensive coverage of the basin but does not possess authority for actions that will encourage integration of the diverse public decision-making entities. The Upper Great Lakes Regional Commission may be faulted in meeting the need for Great Lakes Basin integration by its lack of comprehensive jurisdiction -- both by its limitation to the Upper Great Lakes and by its singleness of purpose.

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* This is a condensation of a report prepared by Mr. Craine as a consultant to the Great Lakes Basin Commission, dated March 15, 1972 (Mimeo). It is reproduced here with permission of the author. The research for this report was supported in part by Resources for the Future, Inc. The condensation was prepared by Robert Schmidt. Responsibility for the condensation is entirely that of the editor. Most footnotes and references are omitted in this condensation.

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[1] A basin "management agency" is defined for the purposes of the report to mean a geographical agency with the capability to provide a flexible manager-like direction to the use of governmental powers affecting the use and development of natural resource systems within specified hydrologic basins.

An assessment of existing agencies dealing with the Great Lakes discloses basic questions about the need for some degree of geographic integration and the institutional mechanism by which such integration will be accomplished. Responding to the need requires an understanding (1) of geographic integration as a new type of government intervention and (2) of the factors that delineate geographical areas for purposes of integrating actions. Obtaining legitimate public authority for effective geographic intervention is basic. It requires different mechanisms than administrative coordination -- the inherited approach to river basins. It calls for institutional innovations, the outlines for which can now only be dimly perceived.

Part III. A Framework for Institutional Change

A framework for guiding institutional change is at best highly subjective. It is therefore important to make the concepts on which the framework is constructed as explicit as possible. The framework for institutional change used in this study is constructed on four propositions which are believed to represent realistically situations in the Great Lakes of primary relevance to institutional arrangements. The four propositions are:

(1) The central problem to which Great Lakes institutions are expected to respond is the need to achieve varying degrees of *geographic* integration of governmental involvement in resource development and *protection* of the Great Lakes Basin.

(2) The geographic integration problem is usually multi-governmental, i.e., it involves several independent governments with separate political constituencies; therefore, its requirement is more for "political coordination" than for "administrative coordination."

(3) Policy, planning, and management direction are three primary processes for achieving integration, and these should be recognized as the principal processes through which geographic integration may be achieved for the Great Lakes or a specific area within the basin.

Policy making is recognized as a primary product of the political process of each political unit. Policies may be expressed in constitutions, statutes, plans, standards, agreements (tacit as well as explicit), and even in executive orders.

Coordinated planning, unlike either policy making or management direction, is not a decision-making process in itself. Planning -- and least of all, "coordinated planning" -- is no better than the decision authority it serves; and if it is not a servant of a decision authority, it is impotent.

Management direction is used to denote a process in which integration is achieved through centralizing power to take specific development and resource-use actions. It is the most coercive of the three considered, coercive in the sense of constraining the freedom of action of the various private or public units involved.

(4) Geographic integration should be conceived as part of a larger institutional system for making public decisions about the use and development of the resources in the Great Lakes. In conceiving an institutional system, the role of each agency in the system and their operational linkages with the others are as important as their organizational forms.

Assessment of Existing Alternatives for Geographic Integration. Using these propositions as a guide, assessment was made of the four institutional alternatives that were considered most promising by the Great Lakes Basin Framework Study Group 20 on Laws, Policies, and Institutional Arrangements. These are: (1) interstate compact; (2) Title II river basin commissions; (3) federal-interstate compact; and (4) Basin interagency committees.

(1) *The interstate compact agency* is represented by the present Great Lakes Commission. Although its scope of interests may be said to be comprehensive, its lack of adequate legal powers necessary for policy, planning, or management and its frugal funding have limited its role to one of information and communications.

(2) *Title II river basin commissions* are represented by the Great Lakes Basin Commission which (in comparison to the Great Lakes Commission) possesses specific authorities to coordinate "water and related land use and development in the Great Lakes Basin." Its powers of geographic integration are principally those of planning. In addition, the Commission has some general "coordinating" responsibilities. In practice, this has largely involved what may be called information, counseling, and persuasion activities. However, this activity carries no weight of authority.

(3) *The federal-interstate compact* is epitomized by the Delaware River Basin Commission (DRBC). The DRBC is often cited as a symbol of one or both of two important "firsts" in the annals of American water resource management. Although there have been many interstate compacts, this is the first in which the federal government is party to a compact with states to support and participate in an operating type of agency. Secondly, this is the first significant innovation in a river management agency since the creation of TVA thirty years earlier. The Delaware Commission stands out as an important experiment in the feasibility of state and federal governments pooling their powers and capabilities for river basin management.

(4) *Basin interagency committees* created by federal interagency agreements in several different river basin regions function under the Water Resources Council but with more limited objectives and responsibilities than the river basin commissions. They serve as tools for executive coordination of planning activities by federal resources agencies. The effectiveness of the Basin interagency committee seems greatest when it serves a specified chief executive.

Based upon the criteria, no one of the four alternative forms appears to fulfill the needs for geographical integration. Specific deficiencies can be identified in each agency form. However, many of the deficiencies may not in fact be deficiencies in the agency form, but rather in the institutional system, or lack thereof, in which the agency has been expected to operate.

To ask the question of the relative advantage of a "compact commission" and a non-compact agency, such as the Great Lakes Basin Commission, is a misleading way to pose the fundamental issue of institutional alternatives for the Great Lakes. Instead, if the underlying question were formulated with the concept of an institutional system in mind, the basic issue may be defined in two successive questions:

(1) What strategies for geographic integration (i.e., by policy controls, planning, or management direction, or combination thereof) are appropriate for the specific conditions of the Great Lakes Basin?

(2) Can the job best be done by a compact or by federal legislation?

Attempts to deal with organizational form without first considering the substance too often makes reorganization efforts pawns in power plays rather than strategies for solving problems.

Part IV. An Institutional System for the Great Lakes

It is crucial at this point to recognize that the appropriate form and operation of an institutional system is likely to change from place to place. The Great Lakes Basin is larger, more diverse, and possesses more flat water than river basins. There are two institutional implications of this great size. First, subbasin areas may be so differentiated that institutional requirements will differ, not only between the Great Lakes Basin as a whole and the specific subbasin area, but also among different subareas which we refer to as regions. Second, the degree of geographic integration, and, therefore, the process by which it is primarily achieved (i.e., policy, planning, or management direction) will be different for the Basin as a whole than for the various specific problem regions within the Basin. These two general conditions establish the principal design parameters in outlining an institutional system for the Great Lakes.

A systems approach to geographic integration is concerned *first*, about the degree of policy, planning, and management powers which should be delegated to a geographic agency as compared to those exercised by agencies of general purpose government; *second*, about the constitution of the governing body of a geographic agency, with due attention to the requirement for representation and to the decision rules; and *third*, about the operational linkages among geographic agencies and functional agencies of general purpose governments. Such linkages must tie the components together into a dynamic responsive system for making "public" decisions about the use and development of Great Lakes resources.

An institutional system for the Great Lakes is envisioned as involving two types of geographic agencies in addition to the "program" agencies of local, state, and federal governments. One type is devoted to geographic integration of programs in the Great Lakes Basin as a whole. The other is devoted to integration in such subareas or regions of the Basin as problems and demands for public action seem to indicate.

A Great Lakes Policy Agency. Policy controls are more appropriate, and management direction less appropriate, in a large region such as the whole basin; the reverse is true for smaller problem regions within the Basin. A basin-wide agency is conceived as utilizing primarily policy controls, together with such planning as reflects and implements the policy. Two institutional strategies for a policy agency are recognized. One is an anticipatory planning approach that emphasizes anticipating needs for policy determinations and the development of policy guidelines. The other emphasizes reconciling of policy issues as they arise. In practice a single policy agency could perform both roles.

A vital function of such a policy agency is to identify problem regions within the Basin for which management direction is required in order to achieve the necessary geographic integration and to sponsor the establishment of an agency suitable for meeting the resource planning needs in that region.

Given these general characteristics of the job to be done by an agency having basin-wide jurisdiction, consideration can now be given to the form or forms such an agency might take. The question of representation on the governing body of a policy-making agency is crucial. Three kinds of representation are essential to the policy role:

(1) Representation of each state in terms of its interest in the Lakes as a sovereign government and as a discrete political economy;

(2) Representation of the federal government in terms of nation-wide concerns for the Great Lakes and of those particular responsibilities over which the federal government is given constitutional domain; and

(3) Representation of the residents of the Basin to speak for the values of special Basin concern -- such as the local economy and environmental quality -- and to participate in decisions regarding trade-offs among different public values and regarding the justification and nature of further governmental intervention in resource and environmental affairs in the Great Lakes Basin.

Each type of representation may have its own selection requirements in order to optimize its political responsiveness. It is also important that a balance of interest be maintained from the three groups of representatives. Preliminary explorations have suggested the possibility of a governing body of 35 members, eight of whom represent the eight states, eight federal representatives, and 19 public representatives distributed among the states roughly in proportion to population in the Basin. Further studies are recommended relating to representation and decision rules for policy agencies.

Regional Resource Management Agencies. For special problem regions it is believed that management direction may be both more necessary and a more viable process for achieving the degree of geographic integration required. The character of each regional management agency will vary with its geographic scope, the nature of the problems dealt with, and the methods chosen for their solution.

The effectiveness of an agency that makes management decisions depends upon the existence of basin-wide policy parameters such as would be anticipated from a Great Lakes policy agency as described above.

Each management agency will generally require authority necessary to integrate, within its geographic jurisdiction, a significant number of Basin management powers as they are applied to a comprehensive set of resource uses. The significant management powers include: information generation and dissemination; regulation of resource use; administration of incentives; and project design, construction, financing, and operation. The planning process in regional resource management agencies will, in general, deal with a system of facilities designed for specific objectives (at a level often referred to as "authorization" planning) and be concerned with the integration of structural and non-structural measures as a strategy of

basin (or regional) resource management. It is in this sense that management planning is distinguished from policy planning, i.e., setting of goals, determining basic resource allocations necessary to goal fulfillment, and promulgating these policy determinations through a framework plan, environmental standards, etc.

With less emphasis upon policy making and more upon management direction, it appears that public representation on the governing body would be less important than on the policy agency. A regional management agency may more logically be governed by a joint board composed of appointed representatives of the several governmental entities served, sharing costs and/or responsibilities. Dealing as they do primarily with choosing methods of resource management, the regional resource management agencies may appropriately encourage public participation by providing advisory groups, channels for appeals, and hearing procedures instead of requiring their governing bodies to contain representatives of the general public. *This conclusion holds only to the extent that the Great Lakes agency or established political processes (federal, state, or local) provide policy parameters for the regional resource management agency that prescribe most of the major resource allocation goals in terms both of quantity and quality.*

Interagency Linkages. An essential feature of the institutional system is the operational linkages among the several component entities of the system. These linkages provide the dynamics of the system. A basic set of inter-agency agreements should be developed that prescribe the critical interactions between key federal, state, and local authorities, the Great Lakes policy agency, and any regional resource management agencies. At this stage, such linkages may best be conceived as those necessary to the policy process, the planning process, and the management-direction process as they serve to provide a basin-wide (or regional) integration of public activities. Prescribing the operational connections among governments, their agencies, and the geographic agencies may be just as important to effective institutional performance as the form of the geographic agency.

Conclusions

(1) *A Federal-State Compact for the Great Lakes.* The present report concludes that a Great Lakes agency is needed to make a specified class of Basin-wide policies. If such an agency is to be effective, it must have clear (even though not absolute) delegation of decision powers from the states and federal government. The federal-state compact device appears to be the most suitable instrument to achieve this. However, it should be noted that this position does not constitute an endorsement of the provisions of the federal-state compact now being proposed for the Great Lakes. A preliminary study of that document suggests that it seeks to give the Great Lakes agency "management directing" powers -- a scope of powers which this study has concluded to be improper for a Basin-wide Great Lakes agency.

(2) *The Role of the International Joint Commission in Water Quality.* A preliminary assessment of the pending Executive Agreement between the U.S. and Canada indicates that the general role proposed for the IJC is not inconsistent with the institutional system envisioned by this study for the Great Lakes. The process of setting water quality standards is a policy process, and the process of negotiating water quality standards with the Canadians is an appropriate intersection of water policy and foreign policy. The institutional implications in the U.S. of an Office of Water Quality within the jurisdiction of the IJC will require more detailed examination when proposals for specific functions become clarified.

(3) *A Great Lakes Agency and the Environment.* Recent concern about environmental quality requires consideration of the program scope of a Great Lakes agency, i.e., to what extent it concentrates on water, "water and related resources," or water and the environment, including land, air, sight, and sound. Two general observations arising from the study may be relevant to the question of program scope. First, a representative body for policy making has less chance of achieving a politically viable policy if its program is too narrow. Good policies are more likely to result from political trade-offs when trade-offs are possible between a range of programs. The second observation would suggest a contrary conclusion regarding scope of subbasin management areas. In agencies where the management thrust prevails, clarity of goals and objectives, and efficiency in their implementation are more readily achieved if program scope is narrower rather than broader.

(4) *A Federal Department of Natural Resources and/or a Land and Water Resources Council.* A current reorganization proposal to transfer the present Water Resources Council to a New Department of Natural Resources, and pending legislation to replace the Water Resources Council with a Land and Water Resources Council, have direct and important implications for organizing the Great Lakes. At this stage, the possibility that either might be adopted does not, however, change the validity of our basic framework, including the institutional system which has been outlined for the Great Lakes Basin in this study.

Appendix C
Biographical Notes on Essay Authors

The following biographical notes on each of the nine authors are taken from *Men of Science: Social Sciences*, 1968 edition, updated as appropriate. Where a particular author was not listed in that directory, the notes have been written to conform to the style of that directory.

BULKLEY, JONATHAN WILLIAM, b. Kansas City, Mo, May 17, 38; m. 62; c. 1. POLITICAL SCIENCE, CIVIL ENGINEERING. S.B. (polit. sci) & S.B. (civil eng), Mass Inst. Tech, 61, S.M, 63, Ph.D. (polit. sci), 66. Instr. polit. factors & civil eng. systs, Mass Inst. Tech, 63-66, systs. analyst strategic mobility, orgn. Joint Chiefs Staff, Pentagon, 66-68; PROF. SCH. NAT. RES, MICH, 68-; U.S.A.R., 66-, Capt. AAAS; Soc. Civil Eng; Polit. Sci. Asn. Application of computer techniques to the generalized problem of optimum resource allocation. Publ: Co-auth, On the water resource problems of Latin America, 10/65 & Simulation of political interaction in multiple purpose river basin development, 10/66, tech. reports, Mass. Inst. Tech. Address: School of Natural Resources, University of Michigan, Ann Arbor, Mich, 48104.

CRAINE, LYLE E(GGLESTON), b. Geneva, Ohio, Aug. 16, 08; m. 42; c. 3. CONSERVATION, PUBLIC ADMINISTRATION. A.B., Oberlin Col, 31; Ph.M, Wisconsin, 37; M.P.A, Syracuse, 50; Ph.D, Michigan, 56. Admin. analyst fed. orgn, U.S. Bur. Budget, 40-42, 45-47; dir. orgn. planning, War Prod. Bd. 42-44; asst. dir. prog. planning, U.S. Dept. Interior, 49-53; from lectr. to assoc. prof. CONSERV, MICHIGAN, 55-58, PROF, 58- Asn Am. Geog; Soc. Pub. Admin. Planning and administration of natural resources. Publ: Muskingum watershed conservancy district: a study in local control, Law & Contemporary Prob; Co-auth, Organizational arrangements for water development, Natural Resources J, 4/62. Address: School of Natural Resources, University of Michigan, Ann Arbor, Mich, 48104.

HUFSCHMIDT, MAYNARD M, b. Catawba, Wis, Sept. 28, 12; m. 41; c. 2. PUBLIC ADMINISTRATION. B.S, Illinois, 39; M.A, Harvard, 55, D.P.A, 64. Res. assoc. pub. admin, Harvard, 55-65; PROF. CITY & REGIONAL PLANNING & ENVIRON. SCI. & ENG, NORTH CAROLINA, CHAPEL HILL, 65- Consult, Resources for Future, Inc, 54; City of Phila, 55-56; Del. River Basin Adv. Cmt, 56-58; U.S. Bur. Budget, 61; Off. Sci. & Tech, 63; Coun. Econ. Advisers, 65-66; U.S. Dept. Housing & Urban Develop, 66-; Pan Am. Health Orgn, 67; U.S. Army Corps Engrs, 67-; Arthur D. Little, Inc, 67- Soc. Pub. Admin; Regional Sci. Asn. Regional and environmental planning; water resources planning; public investment theory and techniques; metropolitan planning process; natural resources policies, programs and administration. Publ: Co-auth, Design of water-resource systems, 62 & Simulation techniques for design of water-resource systems, 67, Harvard; auth: The Harvard program: a summing up, In: Water research, Hopkins, 66. Address: 912 Kings Mill Rd, Chapel Hill, N.C, 27514.

KAYNOR, EDWARD REED, b. Springfield, Mass, Nov. 8, 23; m. 46; SOCIOLOGY. B.A, Yale, 48, M.A, Yale, 49, M.A, Political Science (Public Administration), Univ. Mass, 62. Analyst, Human Relations Area Files, 51-52; Res. Asst, New Haven Taxpayers Res. Council, 53-54; Res. plan, New Haven City Plan Dept, 54-56; Res. Assoc, Hampden Council, Springfield, Mass, 56-59; Exec. Dir, Chicopee Taxpayers Asn, 59-64; Instr. Soc, Smith Col, 63; Mgr, Gov. Affairs Dept, Worcester Area Chamber of Comm, 64-67; Staff Assoc, Dept. Pol. Sci, Univ. Mass, 67-72; RES. DIR, SPECIAL COMMISSION ON CONNECTICUT RIVER BASIN, 72-; Res. and writing (gov, soc.); Pub. adm. Publ: Co-auth, Institutional patterns in evolving regional programs for water resources management; Co-auth, Limits on the institutional frame of reference in water resources decision-making, Water Res. Bull, D, 71; Citizen input in river basin management: range, intensity, and effectiveness, Water Res. Bull, 72. Address: 100 Chesnut St, Springfield, Mass, 01101.

KNOP, EDWARD, b. Streator, Ill, 40, m. c. o. HISTORY & SOCIOLOGY. B.A, Wartburg Col, 62; M.A, Univ. Arizona, 65 (soc.); Ph.D, Univ. Minnesota (soc.), 69. Instr. and Asst. Prof, Univ. of North Dakota, 65-67; Res. Assoc, Univ. Minnesota Center for Soc. Res, 69; ASST. PROF, COLORADO STATE UNIV, 69-. Theory; community; methods. Mem, Rocky Mtn Soc. Sci. Asn, 71; Mem, Rural Sociological Soc, 71; Secy, Western Regional Ad Hoc Comm. on Migration and Rural Dev, U.S.D.A, 71; V. Chmn, Western Tech. Comm. on the Soc. and Econ. Significance of Human Migration, U.S.D.A, 71-72; Consult. ed, Journal of App. Beh. Sci, 72-74; Consult. ed, Rocky Mtn. Soc. Sci. Journal, 72-73; Mem, Exec. Council, Rocky Mtn. Soc. Sci. Asn, 72-73. Publ: New careerists in higher education, 69; Co-auth, Sheltered sections in the assimilation of poverty adults into a campus community, 69; Co-auth, Rural-urban differentials in community satisfaction, In: Rural Sociology, D, 70; Co-auth, University sheltering of adult poor, In: Journal of Applied Science, May-June, 71. Address: Dept. of Sociology, Colorado State Univ, Ft. Collins, Colo, 80521.

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Publ: Co-auth, Medical public relations & Profile of a metropolis; contrib, Cases in American national government and politics, Prentice-Hall, 66. Address: 1677 Princeton Dr, State College, Pa, 16801

OSTROM, VINCENT (ALFRED), b. Nooksack, Wash, Sept. 25, 19; m. 41; c. 2. POLITICAL SCIENCE. A.B, California, Los Angeles, 42, A.M, 45, Ph.D, 50. Asst. prof. polit. sci, Oregon, 49-54, assoc. prof, 54-58, assoc. dir, Pac. Northwest coop. prog. ed. adm, 51-57; assoc. prof. polit. sci, California, Los Angeles, 58-64; PROF. GOVT, INDIANA, 64- Soc. Sci. Res. Coun. faculty res. fel, 54-; fel, Center Adv. Study Behav. Sci, 55-56. Consult, Alaska Constitutional Convention, 55-56. Mem, consult. team merger study, Louisville-Jefferson County Pub. Schs, 66; task group human uses atmosphere, Nat. Center Atmospheric Res, 66-67. Polit. Sci. Asn; Soc. Pub. Admin.(ed-in-chief, Pub. Admin. Rev, 63-66); Am. Geog. Soc; Regional Sci. Asn. Local government; natural resource policy; political behavior. Publ: Water and politics, a study of water policies and administration in the development of Los Angeles; Co-auth, The organization of government in metropolitan areas: a theoretical inquiry, Am. Polit. Sci. Rev, 12/62; Auth, A continental water system. Political feasibility, Bull. Atomic Scientists, 9/67. Address: Dept. of Government, Indiana University, Bloomington, Ind, 47405.

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