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Regional Water Supply Management Institutions

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REGIONAL WATER SUPPLY MANAGEMENT INSTITUTIONS

By

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Water supply is a major national issue. Contamination of aquifers, heavy development in areas without water supply sources, and dependence on varying river sources lead to water shortages in those areas, and suggest that some type of long-range planning is needed.

An outgrowth of this situation has been the emergence of regional water supply authorities (RWSA) as institutions for managing potable water resources. With the realization that water supplies are limited and must be properly managed, county and city governments are beginning to band together to seek mutually agreeable solutions to water supply problems. They join together recognizing that their union is more likely to produce more efficient, economical, and environmentally sound water management than would result from their independent actions.

It is often necessary to have a facilitating agent (individual, board, etc.) coordinate a negotiating process so that neutral and objective analyses can be encouraged and a mutually beneficial strategy devised. In some cases, solutions to water supply problems may be almost impossible to achieve without the cooperation of all parties having a stake in the solution. Regional authorities have the potential for providing the forum for fostering such cooperative ventures.

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On the basis of case studies of RWSAs in Florida, Washington D.C., and in England and Wales, several conclusions emerge.

In general, water supply problems transcend political boundaries, and where large populations are involved, optimal solutions are unlikely to result outside of some type of regional structure. Political jurisdictions often limit the ability of governmental units to deal effectively with water supply needs.

Institutions for managing water supplies range from formal broadbased authorities to ad hoc agreements on regional policies for operating water supply systems. The nature of the arrangements is strongly influenced by unique circumstances.

Regional solutions to water supply problems in Florida have been somewhat limited in scope (through 1986) in that they tend to focus almost entirely on traditional source development and overlook more comprehensive approaches such as using renovated or saline waters, devising optimal systems operating policies, and exploring the efficacy of improved management through system element linkages.

Water availability is not often the limiting factor in solving water supply problems, nor is technology; it is the difficulty people have in cooperating that allows crisis scenarios to develop. Local government organizations are generally extremely concerned with retaining some level of control over their water services. The key to successful regional ventures is understanding the problem and devising incentives for all affected parties to participate.

Outside financial help may be necessary during during start-up of a RWSA, when the system has not had the opportunity to generate revenue. However, the user-pays principle is preferred and revenues generated from the sale of water should be used to recover costs.

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CHAPTER 1 INTRODUCTION

Water supply is a major national concern. Inland drainage and coastal groundwater pumping have resulted in saltwater intrusion into coastal aquifers, land use patterns of dense development have created intense local pressures related to the provision and distribution of water supplies, and dependence on rivers with their varying flows has created a frequently occurring water-shortage scenario. Furthermore, many water suppliers are faced with tapping sources outside of their political boundaries.

The purpose of this thesis is to explore the pros and cons of regional water management institutions as effective agents for dealing with water supply problems. The performance of water supply authorities in Florida, Washington D.C., and England and Wales is assessed to provide insight as to the suitability of transferring such approaches to other localities. The issues considered include intergovernmental relationships, development and financing of infrastructure needs, protection of fresh water sources, and water systems operation and management.

Chapter 2 discusses the general philosophy of creating a regional water supply authority. Included are typical reasons for their formulation and components that tend to be included as well.

Chapter 3 discusses regional water management in Florida. It includes a discussion of the Florida State legislation creating regional

water supply authorities, and the statutory requirements placed on the authorities as well as the water management districts.

Chapter 4 is an analysis of the regional water supply operating policy of the Washington D.C. metropolitan area. Chapter 5 is an analysis of the regional water authorities of England and Wales. Chapter 6 is a summary of the salient points and includes recommendations for organizing along regional lines.

CHAPTER 2 THE PHILOSOPHY OF REGIONAL WATER MANAGEMENT

Concepts Behind Regional Water Management

Various governmental units have banded together in Florida and elsewhere to form regional water supply authorities (RWSA). The parties involved commonly include city governments, county governments, district boards, or combinations of these working together on water supply issues considered to be of mutual concern. They join together recognizing that their union is more likely to produce efficient, economical, and environmentally sound water management than would result from their independent actions.

Efficiency/Economy

For the purposes of this study, efficiency can be defined as streamlining planning and operations to take the least amount of time and/or money necessary to do a task well. A key to this involves minimizing duplication. It may also involve working together for a solution to a problem that each party is incapable of solving on its own. Economy deals purely with maximizing output for the smallest possible amount of capital.

Efficiency and economy are closely associated. All else being equal, the more efficient an operation becomes, the more economical it becomes. There are several advantages to having only one governmental

body responsible for planning, engineering, and conducting water supply operations within a region. Paperwork for consumptive use permitting may be reduced since a smaller number of applications may result from consolidation. There may also be less chance of duplicating efforts and creating conflicts in planning because fewer parties are involved. Economies of scale for regional management can also be significant. For example, the construction of a single 10,000,000 gallon facility will likely be far less expensive than the construction of several smaller facilities which, in total, produce the same amount.

Effectiveness

A regional water supplier may be more effective in providing service to its customers than subunits working independently within the region. A regional water supply agency has one purpose: to manage the water supply under various conditions. The authority can be staffed with people whose sole concern is water and whose knowledge and expertise are the key to solving the water supply problems of the region. Regional water supply authorities can also be effective mediators in dealing with disagreements among constituencies in their area. It is also clear that in some cases, solutions to water supply problems may be almost impossible to achieve without the cooperation of all parties having a stake in the solution. Regional authorities can usually provide the forum for fostering the needed cooperative ventures.

Environmental Aspects

The environmental benefits derived from regional water management can also be important. Such benefits are realized by dealing with a

more expansive hydrologic system than may be subject to manipulation at a local scale. As a result, decisions can be made about water withdrawals and recharges, both in timing and amount, that can be less stressful on the environment and more effective in meeting water supply needs at the same time.

Historical Reasons

As will be shown, changes in approach to dealing with water supply problems have historically occurred in reaction to a crisis situation. They are usually not the product of foresight and planning in an unthreatening situation, but are instead solutions derived in the face of imminent water supply shortfalls. Threatening situations have also fostered regional management designs. In general, there are at least two categories of players involved in regional water supply considerations: those who currently have an adequate supply of water and those who do not. Reaching agreement between these parties on how a cooperative system can benefit them both is the initial, and often major, issue to be faced.

Ideally, each potential party to a regional plan might be expected to bargain successfully with others to reach an equitable solution concerning the region's water supply. A water market might form, based on supply and demand. Unfortunately, this approach often bogs down in a marsh of turf protection and politics. For example, areas without adequate water supplies are often in a weak bargaining position with water-rich areas unless they can enumerate incentives for merging that are attractive to these areas. Small areas often lack the financing

necessary for the water and for the infrastructure necessary to bring the water home. Accordingly, it is often necessary to have a facilitating agent (individual, board, etc.) coordinate the negotiation process so that neutral and objective analyses can be encouraged and a mutually beneficial strategy devised. The best solution, in a regional sense, must be one that provides each of the parties involved with some tangible gains. Parties who see themselves as losers are rarely willing to cooperate with others even in a scheme that, in the grand sense, may be best for the majority. Strategies such as the game theory approach can be used to optimize economic efficiency and allocate the costs.¹

Components of a Regional Water Supply Authority

Regardless of what form a regional water supply authority assumes, there are some basic elements that must be considered. These elements can be divided into two general categories: structural/physical and managerial.

Structural/Physical

<u>Source.</u> The principal physical water supply element is the source of supply. Groundwaters, surface waters, and combinations of the two can be used. Lack of adequate water supply sources has been a principal motivation for creating a RWSA. Acquiring a source of supply may include obtaining the land on or adjacent to the site for wells or rights-of-way, and constructing surface water impoundments or withdrawal points. Where sources have already been developed by any of the members of a proposed authority, the RWSA can assume their ownership, take over their management and operation, or allow the facilities owner to

continue management subject to a regional schedule. If an existing system is already developed to the point where water can be supplied to the entire region at the time a RWSA is established, all that might be necessary would be for the authority to assume management and/or operational control.

Once the viable water sources are identified, a strategy for allocating supplies from these sources to users must be developed. Each source may supply a particular area or combinations or areas. Furthermore, the allocations may have to be varied seasonally or on some other basis to optimize the dependability of the entire regional water supply.

Transportation systems. Water supply sources must be connected to treatment works and may also be interconnected. Such transportation systems may include pumping stations, pipelines, canals, natural drainage ways, and wells. There are several points to be considered when developing transportation systems. The first is the destination of the source water. Raw water may be transported to one treatment facility or to several. If there is more than one source, these may be interconnected and they may also be used to supply more than one treatment facility. Raw water transportation systems from different sources may often be connected together beneficially. If a particular source is experiencing problems, the supply can be furnished by other sources until the problem is corrected and the source might, under these circumstances, also be a recipient of water from other sources. During critical periods water should be supplied from the sources least affected, and an interconnected regional system offers the potential for this mode of operation. Another advantage of interconnected systems is

that of increased reliability. In the event that there is a failure in one part of the transportation system, water can be supplied from more than one location.

System interconnections can be used on a regular basis or only in emergencies. In either case, service reliability is enhanced and the probability of a location having to go without water for any length of time is small. To what extent the system interconnections are utilized depends to some degree on the extent of interconnection between the systems involved.

Treatment facilities. Treatment facilities may already be in place prior to regionalization. They may be privately or publicly owned and may be left under the ownership and operation of the owners or their control may be assumed by the regional authority. If it is necessary to construct additional treatment facilities, the number and location must be determined. The options include a single plant near the water source, one near the consumer, or several somewhere in between. An advantage of having a single plant is economy of scale, although the cost of distribution would rise accordingly. The disadvantages of having a facility close to the source are the increased possibility for in line contamination and the increased chlorine contact time, if trihalomethanes are a problem. Separate plants may be justifiably built if the number of sources is large and the distance between them is great. When existing plants are used in a regional system and are connected to new sources, upgrading may be necessary. Plants can be upgraded individually or, if the problem is common to all plants, treatment such as aeration may be conducted prior to transportation to the individual facilities.

Distribution system. From the treatment facilities, the treated water flows through the distribution system to its ultimate destination: the consumer. It is likely that an adequate system will already be in place. Still, questions arise, similar to those related to the transportation system. The basic questions are those of determining where the water will be delivered and from what plant(s) it is to be supplied. Here the issue of interconnections is also important. Many regional authorities appreciate the security of an interconnected system with the enhanced service reliability if affords. A point has been raised as to whether system integrity is maintained in this instance. Some feel that the opportunity for contamination of the distribution system increases as the system expands. In addition, the cost may be prohibitive for systems some distance from each other. Possible problems such as these must be weighed against the benefits envisioned from interconnecting.

Management

The creation of a regional water supply authority can be justified by considering the fact that hydrologic systems are usually much more expansive than those of the political jurisdictions they embrace; and the impacts of local actions are often felt far beyond the bounds of those taking actions. Regional water management allows consideration of a larger part of the hydrologic cycle. With this comes the ability and responsibility to manipulate water sources in a manner that minimizes the adverse effects of this manipulation and optimizes the availability of the resource to the entire region. Because the areal extent of a

RWSA is usually larger than that of any of its members, the choices open to it are wider. Choices that a local government can not readily make, such as tapping a source not in its jurisdiction, are open to a regional authority. The operating policy for a regional authority can be responsive to the best use of resources within its region while that of a member local government is constrained by its limited political boundaries.

Management of a system, alone, can be sufficient to meet regional goals. It may be that the facilities and supplies in an area are sufficient to meet the needs of that area, but that the distribution of those facilities leads to water supply problems. Regional management, which considers all facilities in the region, may succeed in alleviating a problem that each component alone could not solve without structural alteration. For example, river withdrawals and reservoir releases for a region may be timed such that adequate supply for everyone is available where it was not previously.

The functioning of RWSAs varies with the nature of the governments that are a party to it. Most regional water supply authorities embrace city and county governments, and perhaps other districts and/or councils. Their effectiveness ultimately rests upon the willingness of these member governments to cooperate and the availability of resources within the regional boundaries.

The periodicity of implementing a RWSA may also be an issue. There is at least one authority, in Washington D.C., that only acts in drought situations, which is the only time presently that meeting water supply needs is a problem. If the RWSA is a solution to daily water problems,

then its daily operation is necessary. However, if water shortages are a concern only in times of crisis, a management structure that assumes regional management control only in those crisis times may be preferable.

<u>Note</u>

1. J. P. Heaney, "Coalition Formation and the Size of Regional Pollution Control Systems", in E. Joeres, and M. David, eds., <u>Buying of</u> <u>Better Environment</u>, Land Economics Monograph #6, LaCross: University of Wisconsin, 1983, pp. 99-120.

CHAPTER 3 REGIONAL WATER MANAGEMENT IN FLORIDA

Chapter 373 F.S.

Chapter 373 F.S. covers a variety of water resource issues including the formation of water management districts and regional water supply authorities. This document guides most of the actions of the Department of Environmental Regulation (DER) and the water management districts relative to managing the state's water water resources.

The authority provided in Chapter 373 for establishing water supply authorities is of interest here. The purpose of these authorities is to more efficiently and effectively manage water supply and distribution within the region. Florida legislators provided for the creation of an entity, where it was deemed necessary, to develop, store, and transport water to counties or municipalities within its boundaries, while at the same time, minimizing the environmental impacts of its actions.

The passage of Chapter 373 showed the commitment of Floridians to addressing problems associated with ensuring reliable supplies of drinking water. For the most part, Florida is underlain by the Floridan and Biscayne Aquifers and has sufficient water for its population. The geographic distribution of water, on the other hand, is unequal to the distribution of the population. In particular, reliable potable water supplies in coastal areas of the state are scarce, and the problem is compounded because the majority of the population resides in these areas.

The Framework For Regional Water Supply Authorities

The purpose of a regional water supply authority is defined in the Florida Water Resources Act of 1972, Chapter 373.1962(1) F.S., as follows:

...regional water supply authorities may be created for the purpose of developing, storing, and supplying water for county or municipal purposes in such a manner as will give priority to reducing adverse environmental effects of excessive or improper withdrawals of water from concentrated areas.

In order to accomplish this goal, there are several things that a regional water supply authority can and cannot do. A regional authority:

1. May request assistance from a water management district in meeting the water supply needs of the rapidly urbanizing areas within the district. ss373.1961(2), Fla. Stat.

2. May request that a water management district establish water production and transmission facilities. ss373.1961(3), Fla. Stat.

3. May request or withhold specific approval of the distribution of water from a water management district to a county or municipality located within the area of the authority. ss373.1962(6), Fla. Stat.

4. May exercise any powers and duties agreed to between the local governmental units which created the authority. ss373.1962(2), Fla. Stat.

5. May upon approval of the electors residing in each county or municipality within the territory included in any authority, levy ad valorem taxes, not to exceed one-half mil. ss373.1962(2)(a), Fla. Stat.

6. May acquire water and water rights; develop, store, and transport water; provide, sell, and deliver water for county or municipal uses and purposes. ss373.1962(2)(b), Fla. Stat.

7. May exercise the power of eminent domain . . . to acquire title to such interest in real property as is necessary to the exercise of its power. ss373.1962(2)(d), Fla. Stat.

8. May issue revenue bonds . . . to be payable solely from funds derived from the sale of water by the authority to any county or municipality. ss373.1962(2)(e), Fla. Stat.

9. May sue and be sued in its own name. ss373.1962(2)(f), Fla. Stat.

10. May borrow money and incur indebtedness and issue bonds or other evidence of such indebtedness. ss373.1962(2)(g), Fla. Stat.

11. May join with one or more public corporations for the purpose of carrying out any of its powers and for that purpose to contract with such other public corporations for the purpose of financing such acquisitions, construction, and operations. ss373.1962(2)(h), Fla. Stat.

12. May authorize the admittance of new counties or municipalities to the authority, upon such terms and conditions as may be prescribed, upon majority vote of its voting members and upon the resolution having been previously adopted for that purpose by the governing body of the county or municipality. ss373.1962(6), Fla. Stat.

13. Is required to design, construct, operate, and maintain facilities in the location and at the times necessary to insure that an adequate water supply will be available to all citizens within the authority. ss373.1962(7), Fla. Stat.

14. Cannot levy a tax in any county or municipality without an affirmative vote of the electors residing in such county or municipality. ss373.1962(2)(a), Fla. Stat.

15. Cannot furnish water and water service upon terms and conditions and rates which will fail to apportion to the parties and nonparties an equitable share of the capital cost and operating expense of the authority's work. ss373.1962(2)(b), Fla. Stat.

16. Cannot engage in local distribution. ss373.1962(2)(c),
Fla. Stat.

17. Cannot exercise the power of eminent domain to acquire water and water rights already devoted to reasonable and beneficial use or to acquire any water production or transmission facilities owned by any county or municipality. ss373.1962(2)(d), Fla. Stat.

18. Cannot give a preference in the right to purchase water to nonparties to the agreement which established the authority. ss373.1962(4), Fla. Stat. The Water Supply Function of the Water Management Districts

Florida's five water management districts were created by ss373.069, Fla. Stat. The districts' obligations and constraints relating to water supply are found mostly in ss373.1961, Fla. Stat. Several of the more pertinent ones follow.

1. The Governing Board of a water management district is authorized to assist counties, municipalities, and regional water supply authorities in meeting the water supply needs of their rapidly urbanizing areas in the following manner:

A. By engaging in planning to assist counties, municipalities, and regional water supply authorities in meeting the water supply needs . . . in such a manner as would give priority to reducing adverse environmental effects of improper or excessive withdrawals of water from concentrated areas. ss373.1961(1), Fla. Stat.

B. [Upon request], by assisting in meeting the water supply needs of the rapidly urbanizing areas within its district in such manner as would give priority to reducing adverse environmental effects of improper or excessive withdrawals of water from concentrated areas. ss373.1961(2), Fla. Stat. (Brackets added by author here and below to reflect deletions in the 1987 amendments)

C. [Upon request], by establishing water production and transmission facilities for the purpose of supplying water to the requesting county, municipality, or regional water supply authority. ss373.1961(3), Fla. Stat.

2. The district shall not engage in local distribution. ss373.1961(4), Fla. Stat.

3. The district is prohibited from depriving any county wherein water is withdrawn of the prior right to the reasonable and beneficial use of the water which is required to supply adequately the reasonable and beneficial needs of the county or any of the inhabitants or property owners therein. 22373.1961(5), Fla. Stat.

4. The district may provide water and financial assistance to regional water supply authorities. ss373.1961(6), Fla. Stat.

5. Upon specific approval of an existing regional water supply authority, or, in the event of the authority's disapproval, the approval of the Governor and Cabinet sitting

as the Land and Water Adjudicatory Commission, the Governing Board may provide water and financial assistance to counties and municipalities which are located within the area of the regional water supply authority. ss373.1961(6), Fla. Stat.

6. The Governing Board may establish works of the district for the purpose of drawing water from the underlying aquifer for supply. ss373.087, Fla. Stat.

7. The district may permit local governments to operate and maintain the works of the district. ss373.084, Fla. Stat.

Groundwater Problems

Because of the abundance of groundwater in Florida, the relative scarcity of surface water impoundments suitable for potable water supplies, and the costs associated with converting brackish or saline waters, the majority of the state's population receives its water from groundwater sources. In fact, over 88% of households on public water supply and 94% of private rural supplies depended on groundwater in 1980.¹ Therefore, any scheme for regional water supply management must address the availability and quality of groundwater resources.

Some coastal regions, such as the Tampa area, have no potential wellfields below them and must look further inland for their water supplies. Other areas such as the eastern portion of Broward County, have had potable water supply wells which have become--or are becoming-polluted from saltwater encroachment. This intrusion has been hastened by increasing amounts of water being withdrawn from coastal wellfields to quench the thirst of a growing population. Excessive coastal pumping lowers the head pressure in the aquifer. Due to the density difference between fresh and saltwater, freshwater floats on top of the saltwater. As the Ghyben-Hertzberg principle states, when an unconfined aquifer is pumped, a one foot drawdown of freshwater will result in a forty foot rise in the saltwater level.²

Inland drainage to facilitate development has also exacerbated the saltwater intrusion problem. Water is often channelized away from recharge areas and into the ocean where it is not available for aquifer recharge. An additional problem can results if land that was available for recharge is paved and the runoff is diverted away. This may constrain natural water level rises in aquifers overlain with such developments. As recharge is diminished and water table elevations fall, saltwater intrusion is facilitated.

In Broward County and other coastal areas of Florida, rapid growth and development, together with inadequate water resource planning, has led to the problem of potable wellfield contamination by saltwater and by chemicals. The cities of Hallandale and Dania are experiencing saltwater intrusion problems at this writing and are concerned about the future of their water supplies. Hallandale is bargaining with nearby Dade County to purchase water until Broward County is in a position to aid the city.³

Since water is generally more abundant on a regional than local scale, it is logical to consider managing it on a regional basis. Technological advancement allows us to live in areas where the needed resources to live are not directly available. Thus to develop areas only where there are adequate local water resources might not always be wise. Patterns of commerce, industry and residential use have been established in many localities with limited water supplies and must be recognized. While attempting to stimulate additional growth in heavily urbanized areas might not be desirable, residents want their services

maintained. Therefore, from a political standpoint, maintaining services at the current level of development makes sense. Florida's coastal regions are preferred areas and regional approaches to solving their problems seem to offer good potential. An issue that must be dealt with, however, is that areas with abundant water supplies are often concerned that their rights to the water may be lost if their water is transported for use in other areas. Furthermore, these exporting areas are often afraid that they may also be called upon to help finance the infrastructure necessary to transport their water to other localities. The supplying areas have the resources they need and ask why they should be called upon to help others who are less waterrich. Such sentiments are easy to understand. No one wants to give something of value away without adequate compensation, and certainly not at a cost.

Regional Water Supply Authorities in Florida

In spite of the difficulties encountered in creating a regional water supply authority, there are some examples of operating authorities in Florida. Currently functioning RWSAs typically incorporate the following: central wellfields, system interconnections, and operation and management control. New wellfields are usually developed in locations where problems created by pumping are minimal. Raw water distribution systems are interconnected such that different wellfields can supply many points in the distribution system. RWSAs often assume responsibility for existing facilities, but sometimes wellfields and other works are left in the hands of their original owners. The latter case is common when the supply involved is too small to serve regional

needs, or the distance involved in interconnecting the supply is too great to justify the expense of the connection.

The directors of the regional authorities in Florida consider interconnections between the raw water distribution systems of different wellfields desirable, but interconnections between the distribution systems handling treated water are not generally made. This is because treatment facilities are privately or municipally owned and are not under the jurisdiction of the regional water supply authorities. At present, RWSAs in Florida are statutorily prohibited from retailing treated water, a measure designed to avoid direct competition with local water utilities. Therefore their immediate concerns end with delivery of the raw water to the treatment facility.

There appears to be no question that in some parts of Florida it will be necessary to regionalize water supply management if adequate supplies of water are to be available for future increases in population. How this should be accomplished, however, is not an easy issue to resolve. Whatever options for regionalization are chosen, they must reflect the special circumstances of the area to which they will be applied. In Florida, most water crises have come to a head in coastal areas where the threat of saltwater intrusion is high. This is reflected in the fact that all regional authorities in Florida contain some coastal regions. Some highly developed inland areas, such as Orlando, may also experience increasing water supply deficiencies as they continue to grow. In the future they may need to consider the efficacy of regional water management systems for their supply shortages as well. Ultimately, regional authorities may begin to work together to solve broader water management questions.

Analysis of Existing Authorities

To provide a better understanding of RWSAs in Florida, selected examples of some existing ones are discussed. The West Coast Regional Water Supply Authority, the oldest authority in Florida, was created in 1974, under Chapter 373. The Walton/ Okaloosa/Santa Rosa Regional Utility Authority is an example of a situation where a water management district facilitated regionalization and brought local governments together to face their common problems. The Peace River-Manasota Regional Water Supply Authority is an example of an authority formed by the foresight of its participants in an attempt to avert future water supply crises.

West Coast Regional Water Supply Authority

<u>History.</u> As long ago as the late 1920's, Tampa and St. Petersburg were experiencing water supply problems in the form of salt water intrusion. To combat this problem, Tampa expanded its surface water system and St. Petersburg developed wellfields in the area of Cosme-Odessa, north of the city.

Since then, the tri-county area of Hillsborough, Pasco, and Pinellas Counties continued to develop its water resources, and questions relating to the ownership and control of the resources being tapped were raised. Furthermore, fears that inadequate water supplies would harm the public welfare and economic development stimulated competition for water resources and led to regional "Water Wars".⁴

As a result, a recognition emerged that the West Coast water resource problems were regional in nature and that solutions to them would require intergovernmental cooperation. The original consideration

was to extend the responsibilities of the Southwest Florida Water Management District (SWFWMD) to include water supply. This approach would have allowed the SWFWMD to regulate water withdrawals through issuance of permits, and supply water at the same time. But people were concerned that having the district involved in both water supply and consumptive use permitting would be a conflict of interest. They felt that keeping the functions in separate agencies was more desirable. Thus, an option that provided a greater level of local government control was chosen.

In 1973, the SWFWMD, Pasco County, Pinellas County, and the City of St. Petersburg agreed to develop the Cypress Creek area in Pasco County for the following purposes: water supply, flood control and water storage, wildlife refuge, outdoor recreation, and open space. In August 1973, the Cypress Creek Management Board was empowered to make decisions about the construction and operation of the proposed Cypress Creek Wellfield. This wellfield was to be the first regional water supply facility in the area when completed in 1977.

The Florida Legislature was aware that what was occurring in the Tampa-St. Petersburg area could easily occur elsewhere. Recognizing that intergovernmental cooperation would be needed in many areas to produce solutions to problems of water supply shortfall, the legislature passed Chapter 373, F.S with a section concerning this issue. Section 373.1962, discussed in Chapter 2, deals specifically with the creation of regional water supply authorities: what their functions, duties, and constraints were to be. The section states that authorities may be created for the purpose of developing, storing, and supplying water for

county or municipal purposes in such a manner as will give priority to reducing adverse environmental effects of excessive or improper withdrawals of water from concentrated areas.

In accordance with the provisions of Chapter 373, the counties of Pasco, Pinellas, and Hillsborough, and the cities of Tampa and St. Petersburg undertook the formation of a regional water supply authority (see Figure 3-1). In October 1974, after a Five Party Agreement among these participants, the West Coast Regional Water Supply Authority was established. It was the first such authority to be created. Its stated purpose was to meet the present and future potable water needs of the area, allow optimum economic development, and protect the environment to the maximum extent practicable. Shortly after its birth, the Authority entered into negotiations with the developers of the Cypress Creek Wellfield which led to its management and operation of the wellfield. The Authority began selling water to its first customer, the Pinellas County Water System, on January 1, 1977.

<u>Structure.</u> The West Coast Regional Water Supply Authority (WCRWSA) is headed by a five member governing board. Each city and county commission of the five parties involved appoints a governing board member annually. A county's representative is one of its commissioners and the city's representative is either the mayor or someone the mayor designates. Each member receives one vote and the majority rules. These representatives are not paid a salary, but they can receive reimbursement for reasonable expenses incurred in the performance of their duties.

The governing board elects an executive director, or General Manager, to serve at the pleasure of the Board. In addition there is an



Figure 3-1. West Coast Regional Water Supply Authority.

Office Manager; Director of Engineering, Planning & Operations; Director of Environmental Services; and a Director of Finance. Each of these has a staff as necessary to carry out the duties of that division.

<u>Financing.</u> The Five Party Agreement specified how the Authority was to be funded for the first five years after its inception. Each of the counties, upon signing the agreement, agreed to contribute to the Authority annually. In any one year, the amount was not to exceed \$200,000 involuntarily. The required amount was determined by the formula:

$$Contribution = A/B * C$$
(1)

where

- A = the amount of County Taxable Value as shown on the Final Recapitulation of the Ad Valorem Rolls for the previous year as filed with the Florida Department of Revenue;
- B = the total of County Taxable Value of all the Counties which are parties to the Agreement; and
- C = the amount of funds designated by the Board of Directors to be derived from counties.

The operating budget for the first year (fiscal year 1975) was \$228,960.00. This was used for office space, supplies, staff, and equipment to begin operations. The budget increased to \$476,962 in FY 1976 although \$171,066 was left from the previous year. The contributions of each of the counties in 1976 was Pinellas County with 56%, Hillsborough County with 35.5%, and Pasco County with 8.5%.

Beginning in 1977, the Florida Legislature instructed SWFWMD to provide the WCRWSA a share of its ad valorem taxes not to exceed 0.05 mils on the taxable property within the Authority's boundaries. This was approved for five years of operation and replaced the County contribution formula defined in the Five Party Agreement.

By the end of 1981, the agreement to contribute funds had expired as well as the SWFWMD allocation of ad valorem taxes. By this time, the Authority was able to fund its operation solely from the sale of raw water to the parties involved. Since then, the Authority has continued to fund its operation from the wholesale of raw water to its member communities. The Authority operates in a non-profit mode. Its revenues cover capital production costs, and operation and maintenance expenses. Costs of operations are passed on only to the customers that benefit from them. Costs are allocated between the participants of a project on the basis of the percentage of the total benefit each is expected to receive.

<u>Function.</u> The function of the WCRWSA is expressed in its goal statement. It supplies raw water to the treatment facilities of its constituents. The Directors of several operating RWSAs judge their continued existence to be a measure of performance. If this is the measure, then indeed the WCRWSA is functioning well for it has been in existence for over thirteen years and has been self-supporting for over seven years. Another measure of performance is that of the bond rating. The WCRWSA has consistently received extremely favorable bond ratings. But ultimately, it is considered that the performance of a RWSA should be judged by how well it meets its goal.

For the WCRWSA, feuding among the constituencies has not ended, but now, disagreements do not seriously impede the distribution of water. All constituents receive sufficient water for their purposes. Furthermore, interconnecting several raw water supply systems has been

effective in furthering pursuit of WCRWSA's goal. During environmentally sensitive times water is withdrawn from the wells having the least negative impacts on the water resource. The interconnections also provide for greater reliability in case of water quality emergencies. In short, the more options that are available for serving a customer, the more reliable the system.

The Authority supplies 50-60% of all water delivered within its boundaries. The Authority owns some wells and manages others, and it is effective over the entire region because it can supply water to all of its parts. But it is not the region's only supplier of water; the cities and counties maintain some private wells that have belonged to them for years. At present there are no plans for the Authority to take over all existing raw water facilities, especially since operating some water supply systems of their own gives the cities and counties a feeling of greater control over backup systems. In the future, however, it may be considered desirable for the Authority to assume control of the entire regional water supply. This remains to be seen.

Legal aspects. The two governing documents for the WCRWSA are Chapter 373.1962 F.S. and the Five Party Interlocal Agreement signed by Hillsborough, Pinellas, and Pasco Counties, St. Petersburg, and Tampa in 1974.

Chapter 373.1962 F.S. was created specifically to give the threecounty two-municipality area a way to cope with the problems being created by the so called "water wars" that the area was experiencing. These problems related to the fact that each member was afraid that there would not be enough water for their future needs. Intense competition for the water resulted. The WCRWSA was the first regional

water supply authority to be created by this legislation. The freedoms and constraints placed upon the WCRWSA by Ch. 373 apply to any regional water supply authority. The Interlocal Agreement grants certain powers and duties to the Authority. The Authority, among other things:

1. May acquire personal property necessary or convenient to exercise its powers.

2. May acquire, control, or construct facilities and means necessary or convenient to exercise its powers.

3. May employ and compensate personnel.

4. May invest surplus Authority funds not required immediately for other necessary Authority functions.

5. May exercise powers that can be reasonably implied from the agreement as necessary to exercise its powers.

The Board of Directors:

1. May pass rules and resolutions necessary for the Authority to carry out its function.

2. May create an auditing system for review of claims, demands, and contracts.

3. May fix water sales rates.

4. Shall submit, prior to commencing operations in any fiscal year, a tentative budget for review by the members and each member's constituents.

5. Shall hold a publicized, public meeting to receive input about the proposed budget.

<u>Infrastructure</u>. The WCRWSA started with an advantage; some facilities were already in place. Pasco Utility built a pipeline south to interconnect with Pinellas County prior to the Authority's existence. The Cypress Creek Wellfield had already been designed and was being constructed as a regional water supply system. The Authority stepped in and assumed control of the wellfield. Between the acquisition of the wellfield by the Authority in November 1976 and the sale of water to the first customer in January 1977, only two months passed. In reality, all the Authority had to do to begin operation was to turn on the pumps.

Since then, the Authority has expanded its wellfields and its system interconnections. A goal of the Authority is to be able to serve any point in the system from any wellfield. This goal is well on the way to being realized. The interconnections are used on a daily basis, not just in emergency situations. The grid network is being expanded continually. This distribution networking is limited, however, to the raw water system. Since the Authority has no jurisdiction over treated water, there has not been concern by the Authority about interconnecting this aspect of water distribution.

Seven water supply sources are under the management of the Authority: six wellfields and one canal. The water is supplied to the utility companies of the participants, which were in existence prior to the Authority. Nothing was needed by the Authority after the acquisition of the wellfield and the attached distribution system to begin operation. To operate regionally, it has been necessary to expand the system of interconnections between the raw water distribution lines and also to expand the raw water supply by developing and managing additional wellfields.

<u>Problems.</u> One problem the Authority has to contend with is the continued dissension among the members. The tone is not nearly as frantic as before but there still exists some hesitancy to accept the notion of 'good for the group' as opposed to the individual. This is
not keeping the Authority from doing its job, but it can make it more difficult and protracted.

There is some question as to whether or not the authority, or any authority is actually operating economically. Because all water distributors are required to buy water from the water authority, there is no guarantee that costs will be held low, or that there is an incentive for the authority to do so. A basic premise for regionalization is that everyone should benefit. If the regionalization has formed an inefficient, uneconomical monopoly that charges more than the alternative cost of supply, then steps should be taken by the authority, the water management district, or the legislature to deal with this problem.

Accomplishments. Regionalizing the management of the water supply by WCRWSA has helped to solve water supply problems related to both quantity and quality. The problems of quality are mainly tied to the coastal regions. Saltwater either threatened or contaminated the available water supply there and left no choice but for those water supply agencies to look elsewhere for water. Since the 1920's, the location of wellfields has moved inland. The authority helped to bring order to the chaotic situation that developed as questions about water rights turned into the "water wars".

Quantity problems associated with water supply can be effectively dealt with by the authority because within its boundaries is enough water for the region's entire population. The authority can distribute water as it is needed, but it cannot take water that is already being put to a reasonable and beneficial use in one location and move it to

another. A county's water rights are thus protected, and water can be made available to everyone.

Another outcome of having the authority is the increased environmental protection being experienced in the region. Extensive monitoring and field surveys keep the Environmental Services Department of the WCRWSA busy.⁵ The Authority uses its well systems and interconnections to maintain the water levels in aquifers at acceptable levels for water supply purposes and also for the vegetation and wildlife above.

Although there is still dissension within the region, and even within individual counties, the situation has calmed dramatically since the days of the "water wars" when legislative interference was necessary. This can be attributed mainly to regionalization of the water supply. For the first time in many years, confidence is higher that needs are being considered and rights are being preserved. This is because through the authority structure, their input is taken and they have a vote in the final decisions. The State Legislature's intervention in the situation was needed at the time of inception but is no longer necessary. The WCRWSA is now supplying raw water to its members without tax money, and is a viable, environmentally aware, institution. The principle of "user pays the costs" is key to many accomplishments of the Authority.

Walton/Okaloosa/Santa Rosa Regional Utilities Authority

<u>History.</u> As early as the mid 1970's, the Northwest Florida Water Management District (NWFWMD) was conducting studies of groundwater, the only water supply being used at that time. They found the drawdown of the aquifer beneath Ft. Walton Beach was the largest anywhere in

Florida. Salt water was found inland: whether or not this condition was manmade was not determined. Panama City noticed increases in the chloride concentration of wells. As a result, the district began looking at geography. West Panama City, Walton, Okaloosa, and Santa Rosa Counties were peninsular. Eglin Air Force Base (AFB), the largest AFB in the U.S., effectively cuts off the beach cities from the rest of the state. The AFB also contains vast amounts of water that is not being utilized. These coastal areas asked Eglin for permission to put in supply wells but were denied.

In 1977 the NWFWMD began a five year study of the physical interrelationship between the unprecedented level of development and its resulting population growth, and the water resources in the southern portions of Bay, Walton, Okaloosa, Santa Rosa, and Escambia Counties. A report, <u>Regional Water Supply Development Plan for Coastal Areas of</u> <u>Northwest Florida</u>, was the result of this analysis.⁶ During the study, it was noticed that similar planning was needed for wastewater treatment and disposal and solid waste management.

In the late 1970's, people began to realize that there was an impending water shortage. The district made a study of the region's public water supply systems and facilities.⁷ Approximately 70 systems were identified. It was determined that many of the systems overlapped, that there was little backup capability, that there was sparse capital for new wells, and that little communication occurred among the water suppliers. If someone needed water, the approach was to extend a pipe.

District studies determined the amount of water that could be supplied from coastal areas and quantified regional demand. For some areas it was predicted that new supplies would be needed within as few

as three years when the one day demand was used in making calculations. Buildouts in some areas, based on several different population projections, were projected but residents were skeptical of these estimates. The district explored options for expanding water supplies. They looked at ground water, surface water, desalination, conservation, reuse . . . to determine which would be the most cost effective. The most economical option appeared to be the development of a wellfield on Eglin AFB. But Eglin was wary of this for several reasons. First, the government was in the process of reclaiming some land that had been allocated to the military and the base did not want the federal government thinking that the land was not needed and not being used. Second, the proposed wellfield site was located in the shadow zone of a bombing range. Finally, Eglin was not enamored with the prospect of dealing with a host of local governments individually: they wanted a focus.

Four approaches were identified as feasible for accommodating the last concern of the Air Force. They were as follows

- to take a 'lead agency approach'. One unit of government would sell water to other units. The water would be bought wholesale from the AFB,
- 2) to have the NWFWMD develop a wellfield on Eglin AFB. The district could bond and finance the wellfield and lease the property to a lead agency or consortium,
- 3) to have the district function as a RWSA, and
- 4) to have several governments band together to form a RWSA.

The 1982 Regional Water Supply Development Plan recommended Alternative Three. However, Chapter 373 required that the district be asked for assistance prior to becoming involved in an area's water supply problems or establishing water production or transmission facilities. In addition, Chapter 373 prohibited the district from engaging in local distribution of water. The local governments involved considered that a conflict of interest might result from having the same agency issue consumptive use permits and sell water, and ruled out Alternative 3. Again, progress toward regional management was stalled.

The Northwest Coast Resource Planning and Management Committee was created in 1983 by Governor Bob Graham (Florida Statute 380.045) to develop and implement a resource management plan for orderly growth in the Okaloosa and Walton County coastal areas. By March of 1985 the committee had completed its task in a manner acceptable to the Governor and Cabinet. One of the recommendations was the creation of a regional water supply authority for the area. The plan's recommendations were to be implemented within one year, but few of them were, and the reasons for this were of concern to the Committee.

In response, the local governments created a Coordinating Authority to convince the Department of Community Affairs, the agency charged with monitoring implementation of the recommendations, that progress was actually being made. The purpose of the Coordinating Authority was to develop plans for regional approaches to water supply, wastewater disposal, and solid waste management. After several months of no progress, and after the failure of repeated attempts to spur action, the Intergovernmental/Coordinating Subcommittee (the subcommittee charged with monitoring implementation progress) voted unanimously for the local governments to abolish the Coordinating Authority and establish the type of authority originally recommended by the Committee. The Regional Planning Council was to act as the staff for the authority until it was

established and the necessary studies concerning wastewater and solid waste were begun. The Coordinating Authority was abolished by the local governments. An Executive Committee was created by them in its place to function until an authority could be created by interlocal agreement and approved by the Secretary of DER.

For the first time, input from the NWFWMD was readily accepted by the local governments. Technical, administrative, and legal assistance was furnished. The district encouraged the Executive Committee to persuade southern Santa Rosa County to join the authority. The district believed that this area should be involved because it would need an alternate water source in the near future. It was the decision later to include sewage functions in the authority that finally convinced Santa Rosa to participate, because it was having difficulties in that area.

On September 23, 1986, an Interlocal Agreement became effective and the district prepared documentation of the need for a regional authority and sent it to the DER for approval. On October 15, 1986, the Secretary of DER signed the order sanctioning the creation of the Walton/Okaloosa/ Santa Rosa Regional Utility Authority (see Figure 3-2).

The district aided the local governments in their efforts to create the Authority, and helped them to develop the scope of work for feasibility studies on sewage and solid waste. Thirty thousand dollars were contributed by the district and by the Department of Community Affairs for funding of the needed studies. Eight local utilities also contributed to the effort by providing the sum of \$12,500. At the request of the Authority, the district negotiated with the contractors who were bidding for the engineering and feasibility studies. These studies are scheduled for completion by August, 1988.



Figure 3-2. Walton/Okaloosa/Santa Rosa Regional Utilities Authority.

Although the authority is chartered as a Regional Water Supply Authority, it is called a Regional Utility Authority (RUA), since its mission also includes regional management of wastes and sewage effluents. Although RWSAs were not at that time expressly authorized by Chapter 373 to handle solid waste, there was nothing in the Statute that stated the authority could not engage in other endeavors. The 1987 amendments to Chapter 373 authorized wastewater management.

Structure. The governments involved in the Authority are the counties of Walton, Okaloosa, and Santa Rosa, and the cities of Freeport, Destin, Fort Walton Beach, and Gulf Breeze. The Authority is governed by a panel of two representatives from each county and one from each city. These representatives are appointed by the respective Boards of County Commissioners and City Councils. They serve staggered threeyear terms and are not limited as to the number of terms they may serve. For voting, the majority vote of the quorum is necessary to pass a motion. Board members are not compensated for their efforts and there are are no support personnel at present. The group of representatives is allowed by Organization Rule 49-1 to elect four officers for an unlimited number of two-year terms. A Chairman presides over meetings, signs Authority contracts, and performs other duties assigned by the Board. A Vice-Chairman acts in the absence of the Chairman and performs other duties assigned by the Board. The Treasurer handles receipts and disbursement of funds. The West Florida Regional Planning Council is charged with the duties of treasurer until the Authority elects its own. The last office is that of Secretary. The Secretary prepares and distributes copies of the meeting minutes and performs other duties as assigned by the Board. Other officers may be appointed as needed for

two-year terms. The first order of business is the initiation of studies to produce viable options for sewage and solid waste management in the region.

Financing. Financing mechanisms for the Authority are not yet in place, and their design is constrained somewhat by the Charter which prohibits the use of ad valorem taxes to fund its operations. Clearly, all participants will have to agree to contribute in some way if the venture is to be successful. Local contributions and bond issues are among the approaches being considered with some agreement that guarantees income, such as a contract to purchase a minimum amount of water, supporting the start up capital. Bond issues could cover many of the capital expenses and local contributions could be raised through utility fees. In this way, the users would be the ones to pay the costs associated with the Authority. According to Mr. Buddy Runnels, Chairman of the Governing Board of the NWFWMD, and Chairman of the Northwest Florida Coast Resource Planning and Management Committee, "The success of this Regional Utility Authority will depend largely on how we fund it. One possibility is to use a formula so that the user, including the larger developments, pays a pro-rata share based on the increase in density that results. The costs thus would not be born by local residents through ad valorem taxes. The counties will almost always resist an increase in ad valorem taxes, and the state doesn't have the money to finance this Authority".8

<u>Function.</u> The Authority is conducting studies of the needs for sewage treatment and solid waste. The Regional Water Supply Development Plan has been finished by the district and serves as the platform for

water supply improvements. The Authority is evaluating the efficacy of connecting all of the major water systems, with some connections having already been made. The Authority plans to function regionally in supplying the water needs within its boundaries. Once the studies of wastewater and solid waste management are completed and the viable options defined, the Authority plans to become active in these areas also.

Legal aspects. The legal basis for the RUA is embodied in Chapter 373 F.S., the Interlocal Agreement Creating the Walton/Okaloosa/Santa Rosa Regional Utility Authority between Walton, Okaloosa, and Santa Rosa Counties, and Organizational Rule No. 49-1. The Interlocal Agreement is dated 11/23/86. It was formed in accordance with Section 373.1962 and Section 163.01, Florida Statutes. In the Agreement, the participants agreed to be the sole authority producing and supplying water regionally. The Authority is to provide wholesale water only and not to engage in the distribution of treated water. It may, however, engage in the disposal of solid wastes or the disposal of treated sewage effluents, consistent with Florida law; but the applicable laws are not defined. As far as solid wastes are concerned, the legal authority for collecting, treating, and recovering wastewater was provided in the 1987 amendments to Chapter 373.1962(2).

The funding intent is stated to be "user pay." Initial administrative costs as well as the feasibility studies, however, must be obtained from member governments, the Department of Community Affairs, the NWFWMD, and appropriate utilities. After the studies on sewage and solid waste are completed, a separate agreement about them will be made binding the members to an action plan. Funding for anticipated programs

will have to be provided for by participating members. The Interlocal Agreement allows member cities or counties to develop or expand water and wastewater systems within their boundaries and provides that members can withdraw from the Authority as long as their contractual obligations are met.

Organizational Rule No. 49-1 specifies the organizational framework and operating procedures of the Authority. It describes the RUA and sets forth its purpose which is to take whatever measures are needed to ensure the region an adequate water supply in an environmentally sound manner. The Authority is also charged with providing for sewage effluent disposal and solid waste management facilities. In carrying out its duties, the Authority is constrained from depriving the prior right to water of any city or county already putting it to reasonable or beneficial use. Preference for water supply is given to customers who are members of the Authority. Finally, the Rule defines the method of representation and the officers, as described in the section on Structure. The Rule defines the rules for agenda, scheduling of meetings and workshops, committees, and procedures for contracting for professional services.

Infrastructure. To begin operations, the RUA will have to develop the proposed wellfield on Eglin AFB and construct the distribution system to supply the water to the member governments. The Authority is considering connecting all of the major distribution systems so that the source of supply can be varied as desired by the Authority. Some system interconnections have already been built. For example, Okaloosa County's system is already connected to that of Fort Walton Beach. The Fort Walton Beach system is connected to that of Mary Esther, and there are plans to connect the Okaloosa County system to that of Destin, which is already connected to the South Walton Utilities system. These existing linkages create an excellent beginning for a highly interconnected system.

Analysis. The Authority is too young for a record of successes and failures. So far, the main problem has been overcoming the constraints of forming a regional Authority. Years after major water supply problems had been identified and the Regional Water Supply Development Plan had been completed, the local governments in the region were still resisting efforts by the NWFWMD and other agencies to aid them in solving their problems. It took an order from the Department of Community Affairs, charged with seeing that the recommendations suggested by Governor Graham's Northwest Planning and Management Committee for Okaloosa and Walton Counties were implemented, to get the local governments organized in a collaborative fashion.

Establishment of the RUA has provided the local governments with a focus and institution for dealing with Eglin AFB. Furthermore, because of the cooperative spirit this has kindled with the the AFB, the area served by the Authority now appears to be assured of a reliable water supply for about the next 30 years.⁹

Peace River-Manasota Regional Water Supply Authority

<u>History.</u> Two factors were decisive in the formulation of the Peace River Manasota Regional Water Supply Authority (PRMRWSA). The first was the severe drought experienced in 1980-81. This event created a public consciousness of how sensitive their water supply was to the vagaries of

nature. Public officials and citizens both realized that they needed to take steps to ensure that the problems associated with water shortages would be minimized. The second factor was the interest shown by the SWFWMD in groundwater protection and regional water supply stability. The SWFWMD was in the process of expanding its program to deal with water shortages and problems of temporal and spatial water supply availability. The SWFWMD supported the creation of water supply authorities as a means for addressing these problems in its region.

On the basis of its experience with the formation of the WCRWSA, the SWFWMD concluded that for the Peace River-Manasota region it would be best to develop the regional authority before conditions got out of hand and another "water wars" scenario emerged. The district saw the need for a comprehensive network for the distribution of water supply in the area and it transferred that perception to the local people. It began to orient the thinking of local governments toward creating their own water supply authority. This was accomplished by having its staff go into the area and tell the locals of the problems they were sure to face: such as saltwater intrusion and limited sources to handle the projected growth. Local politicians were motivated because they knew that drought conditions adversely affected their constituencies. They also realized that their ability to handle water supply problems exceeded their jurisdictional boundaries, and that to find effective solutions they would have to band together. It appeared that a water supply authority could accomplish what was needed and the district gave policy and monetary support.

<u>Structure.</u> The Peace River Manasota Regional Water Supply Authority is made up of Manatee, Sarasota, Charlotte, and De Soto

Counties (see Figure 3-3). Hardee County was originally a member, but has since dropped out of the Authority. The county commission for each member county chooses one representative to serve on the Board of Directors. The Board makes policy and decisions. Each member gets one vote, and to do anything, the vote from the Board must be unanimous. Responsible to the Board is the Executive Director (E.D.), who at this time is a consultant working part time. The E.D. provides administrative service to the Board. There are no other employees. The E.D. is aided by four county staff members: one provided by each member county that works with the E.D. in carrying out the duties of the Authority. The function of these staff persons is to represent the interests of their counties. Communication between the staff people and the E.D. at staff meetings allows issues to be worked out before board meetings.

Financing. The SWFWMD has helped the Authority financially. In 1987, however, it was determined that funding for operations should be by weighted contributions from members. Each of the four counties pays one-eighth of the total budget and an additional percentage based on its percentage of the region's population. This method was chosen because of the large differences in population between the counties. All members are expected to benefit from the authority in ways besides water supply: for example, through emergency interconnections. This financing approach is believed to reflect the conditions that will exist in the future, when all the benefits of the Authority start to be realized. Except for Charlotte County, the counties chose utility fees to provide their share of the funds. Because Charlotte has no utility system at present, it relies on ad valorem taxes to cover its contribution.



Figure 3-3. Peace River--Manasota Regional Water Supply Authority.

Function. The RWSA's initial function was to address the need for emergency interconnections, and a three phase study was designed. The first phase was a detailed inventory of systems: the location of all water lines, the systems layouts, existing system links, projected water use, existing sources, future sources, and water quality. This information was to be integrated into a computer system compatible with that of the SWFWMD. Phase two was designed to take the data gathered in phase one and to assess the feasibility of various alternatives for linking the major treated water systems. If the systems were to be linked, to what degree should this occur? In the event one system failed, should the volume of water that could be transferred be enough to meet minimum health needs or enough to maintain the previous level of service? This issue has not yet been decided. If the decision is the latter, then the system's capability must extend beyond emergency needs and be such as to support ordinary water demands system-wide. So far, however, a goal of supplying water anywhere in the region from any source has not been articulated. Phase three is to be a plan of action. Its purpose is to assess the institutional, financial, political, technological, and other aspects of interconnecting the existing systems in the manner decided upon and to make recommendations on how to implement the plan. The nature of interlocal agreements necessary to implement the recommendations would also be set forth. Phase three is scheduled for completion in 1988.

Legal aspects. Chapter 373 F. S. governs the Authority, along with the interlocal agreement between the authority and the SWFWMD signed on November 6, 1985. In the Agreement, the participants agreed that a

prime function was to study the concepts and methods of supplying water in compliance with Chapter 373.1962 F.S. It also was the responsibility of the authority to evaluate the feasibility and design of an emergency interconnection system. For this study, the SWFWMD agreed to pay up to \$200,000; and for the first year of operation, the district allocated almost \$56,000 for general authority support. Funding for anticipated programs will be provided by participating members.

Infrastructure. Major sources of water in the area are surface waters from the Manatee and Peace Rivers, located at the extremities of the region. The fresh surface and groundwater systems are limited partly due to salt contamination in coastal areas, although reverse osmosis is used, particularly in Sarasota County. Currently, each county has an adequate water supply except for Charlotte, which would have problems if their water supplier, General Development Utility (GDU), stopped selling to them. All the counties in the RWSA do not presently own and operate county water supply systems. Manatee County has an extensive, interconnected county water supply system. De Soto County has no county system and Charlotte County depends completely on GDU, which is privately owned. Sarasota County has several private systems but is in the process of converting them into county ones.

Prior to formulation of the RWSA, there existed some linkages among the water supplies in the region. Water from Manatee Reservoir can be transferred to Sarasota County. The General Development Corporation on the Peace River in De Soto County withdraws water from the river during periods of high flow, stores it, and makes it available to its developments in Charlotte and Sarasota Counties. Interbasin and intercounty transfers were common prior to the formation of the RWSA and facilitated

the cooperation between these particular counties. There does not appear to be an urgent need for any further transfers at this time. Hardee is the single county that is not linked to any other. It felt that its participation in the authority was desired because it had vast amounts of water. It saw no benefits to itself, and therefore withdrew from the first interlocal agreement.

<u>Analysis.</u> Because the RWSA has so limited a mission, and because its studies are still underway, progress is hard to judge. But it appears that the SWFWMD may question viability of the authority on the grounds that it isn't moving fast enough in developing a plan for the future. The authority, however, seems comfortable with its pace. Once the second and third phases of the study are complete, a better assessment of performance can be made.

The accomplishments to date center around the initiation of the study designed to consider the need for interconnecting systems to create a better capability for dealing with emergency situations and to establish a long-term planning program to address water supply needs to the year 2015. The counties are also looking at expansions or improvements in their water supply facilities. Sarasota County is working to expand its system and Manatee County is adding wells and also supplying water to Sarasota County. During the last major drought, when the water level in the Manatee reservoir dropped to the intake elevation, the county tapped upstream agricultural wells and transported water through pipes and channels to the reservoir to keep its level from dropping below the water supply intake elevation. At present, Charlotte County is considering the wisdom of purchasing the GDU facility.

Although no structural changes have occurred as a result of establishing the authority, there has been a common acceptance that a regional solution to the problems of the area should be pursued. There has also been a major educational program which has created an awareness of the need for a regional approach. The acceptance of the authority has been based largely on the belief of the member governments that the Authority exists to serve their collective interests. When asked how that came about, Mr. E. D. Vergara, Executive Director of the authority, said "You say it over and over again. You explain to them that they are members, they control it, it is their water supply authority, it exists to serve their needs. SWFWMD does not own it, they have no influence besides providing funding."¹⁰

The counties involved are satisfied with the progress being made. The authority is still in existence, the study is underway, and the forum provided seems to have had a positive impact on staving off some possible conflicts.

Water Management Districts as Regional Water Supply Authorities

Besides cooperative regional water supply authorities the only other agency to be seriously considered as a candidate for regional water supply managers in most of Florida are the water management districts. The districts are already involved in water supply management by issuing consumptive use permits. Many local, county, and SFWMD district staff believe that the SFWMD should or must extend duties to include this aspect of water management in order to 1) fulfill its mission of complete water management, and 2) protect water resources to the greatest extent possible. The SFWMD has the staff, the expertise,

and the financial backing that could make it an effective water supply manager.

Many others in Florida believe, however, that the districts are playing their appropriate role already: one including permitting along with technical, legal, administrative, and financial support and guidance. This is particularly true for local and county officials, and RWSA heads. Some district members are wary of becoming water suppliers. To be the ones called by the consumer with a dry tap is a level of responsibility that many district personnel are not eager to commit. County staff tend to lean more heavily against that level of district involvement. Local and county officials that have made plans for their water supply do not want their authority usurped by the districts. As far as many local officials are concerned, the closer that the control over their water supply stays to them, the better. There may even be some concern about the county taking control from the city especially if there have historically been problems between the two, although county officials may be somewhat accountable for their actions by way of elections. To some city managers, the district is one step too far for direct accountability.

There is concern from all levels about the ability of the district to effectively manage water supply for the same area it is in charge of regulating. It is considered by many to be a conflict of interest to have the agency issuing the consumptive use permits be the same one applying for them. "Putting the fox in the henhouse" is a valid phrase that surfaces often in discussions about this issue.

The district level does have capabilities, however, that can make it an appropriate level of government for water supply issues to be

handled. They have the concern, the expertise, and a financing capability. The South, Southwest, and Northwest Florida Water Management Districts have demonstrated their commitment to long-range water supply planning in order to provide a reliable supply of drinking water in an environmentally safe manner. They have done this by supporting in every way possible the efforts of local governments as well as persuading the governments to undertake steps in this direction.

One thing that the districts may lack, however, is a level of local involvement. The districts may not be as aware of the exact characteristics, physical or institutional, of an area in question. With a water management district as the water supplier, it will be necessary to schedule meetings with local officials to include them in the district's plans. With that one step further from local concerns comes the need for a much more comprehensive public education and information program. Many county and local officials may feel resentful about their lost authority. District efforts to convince the local officials that the district is out to meet everyone's needs will be critical: as well as the sincerity behind the assurances. The skills and knowledge of the local and county officials may prove to be invaluable to the district also. Counties and cities may establish boards for the purpose of giving cohesive, unified input to the district. The district should seek--and use--information obtained if it intends to supply or remove water from an area.

When Chapter 373 F.S. was created, the Florida Legislature added the condition that water management districts must be asked for their involvement by county or local governments prior to building water

production or transmission facilities or meeting the water supply needs of an area. That helped to eliminate problems associated with conflicting interests. The district could not name itself a region's water supplier unless its presence was desired by the region. The Legislature, at the writing of Chapter 373 F.S., did not suggest the water management districts enter into a new area, rather the legislation allowed for the creation of new authorities.

Legislative Update and Implications

Recently this attitude has changed. In the 1987 Legislative session, some important changes were made. Amendments were passed that change the water supply role of the water management districts in Florida. Chapter 373.1961 F.S. has been amended such that a district's aid need not be requested for the district to take action. Section 7 further authorizes a district the power of eminent domain outside of its boundaries for acquisition of typical facilities necessary for supplying water as long as the district within which the property is located does not object.

A new section was added with the amendments: ss 373.2295 F.S., covering interdistrict transfers of groundwater. The district wanting water must apply for a permit from the governing board of the district with water. Section 4 states that the permit shall be issued if the application is consistent with public interest under Section 373.223 and the new Section. Consideration is to be given to the future populations of both areas (losing and gaining water), to the urgency of the need, and the needs of the area losing water. If local governments from which or through which groundwater is to come deny permit, the Land and Water

Adjudicatory Commission will hear the appeal and may reverse, modify, or approve the local government's action.

The SFWMD sees this legislative action as a major new mission: water management districts are now in the water supply business. Many see this new action as a logical extension of the districts' duties and believe that the districts will be better able to handle water supply problems and demands. There is no plan to rush in and assume control of facilities across the state when there is no cause. But now that the authority exists for the districts to become involved in water supply, they can begin in areas of critical concern.

However, concern still exists about the ability of a district to regulate itself. In the legislation, the DER has the power of review over permits. In any case where there is belief that a district may not be acting appropriately in issuing or denying a permit, the decision can be appealed to the DER who will review and ultimately decide upon the fate of the permit.

A question is raised by the new legislation of the level of involvement the district should have relating to water supply. Should the district should go as far as fixing broken water lines or should they only develop facilities and let county or city officials handle the more routine aspects of water supply. In discussions with county and local officials in Broward County, Florida, the general attitude that prevails is the keeping of local aspects local. The facilities and personnel exist already that maintain an area's water system. The district should try hard not to take jobs away from people. To do this, the district would either have to let the local operators in the area handle the maintenance aspects of water supply, or incorporate agencies or utility divisions into its own structure. Either way, there must be local help available for emergencies; the level of common and emergency service must not decrease.

Although the districts have financing capabilities, with the new mission, some districts may not have enough money available to accomplish much. Annual Reports and Audited Financial Statements for Fiscal Year 1983-4 from the five water management districts showed the SFWMD to be by far the best off financially with over \$521 million in assets and an ad valorem taxing capability of 0.80 mill. The SWFWMD has an ad valorem taxing capability of 1.00 mill. Its total assets were over \$158 The St. Johns River WMD had assets of over \$54 million million. although its taxing capability is only 0.375 mill. The Suwannee River WMD had almost \$10 million in assets and has a 0.75 mill limit. The NWFWMD had only \$4.8 million and has a taxing capability of only 0.05 mill. Clearly, if the Florida Legislature is serious about the districts performing water supply functions, it may be necessary to subsidize some districts' operations or to change or add to the funding mechanisms available to the districts.

<u>Notes</u>

1. E. A. Fernald and D. J. Patton, eds., <u>Water Resources Atlas</u> <u>of Florida</u>, Tallahassee: Florida State University, 1984, p. 36.

2. C. W. Fetter, Jr., <u>Applied Hydrology</u>, Columbus, OH: Charles E. Merrill Publishing Company, 1980, p. 141.

3. S. Rosenburg, Mayor of the city of Hallandale, FL, in a personal interview on April 2, 1987.

4. S. H. Emery, Director of Environmental Services, West Coast Regional Water Supply Authority, in a personal interview on March 25, 1987.

5. Ibid.

6. Barrett Daffin and Carlan, Inc., <u>Regional Water Supply Development</u> <u>Plan and Engineering and Financial Feasibility Study for Coastal Areas</u> <u>of Escambia, Santa Rosa, Okaloosa, Walton and Bay Counties, Florida,</u> Havana, FL: Northwest Florida Water Management District, 1982.

7. Ibid., p. I-5.

8. Northwest Florida Water Management District, <u>The Pump</u>, "Interview With Buddy Runnels" Newsletter: Volume 9, No. 4, Havana, FL: Author, October 1986.

9. R. McWilliams, Staff Member of the Northwest Florida Water Management District, in a personal interview on April 14, 1987.

10. E. D. Vergara, Director Peace River-Manasota Regional Water Supply Authority, in a personal interview on March 27, 1987.

CHAPTER 4 REGIONAL WATER MANAGEMENT IN THE WASHINGTON, D.C. METROPOLITAN AREA

Background

Growth in the Washington D.C. Metropolitan area (WMA) has proceeded over the last decades at a rate that magnifies the potential for water supply shortages. The Potomac River, the major water supply source for the WMA, is largely unregulated, however, and it exhibits a wide flow variation that has ranged from over 1135 million m^3/day (cubic meters per day) to less than 1.5 million m^3/day . The average annual flow is about 26 million m^3/day . The record low flow occurred in 1966 during the worst drought of record. Accordingly, a flow value of 1.47 million m^3/day has been established as the measure for describing water supply problems in the WMA.¹ Clearly, for such a populous region dependent on a varying flow, an equitable way to distribute the resource in times of short supply is necessary.

The water supply system for the WMA consists of several reservoirs, the river, and various treatment facilities (see Figure 4-1). Bloomington Lake and Savage River are upstream reservoirs whose releases arrive in the WMA after 4 to 5 days. There are also two reservoirs in series on the Patuxent River, a river northeast of D.C. that feeds into Chesapeake Bay. These reservoirs have a combined storage of 10 billion gallons and a safe yield of 35 mgd (million gallons per day). There is a treatment plant on the lower reservoir with a capacity of 65 mgd that



Figure 4-1. Major Tributaries and Water Supply Facilities of the Potomac River Basin.

supplies the Washington Suburban Sanitary Commission (WSSC). A treatment plant on the Potomac also supplies the WSSC with a capacity of 240 mgd.² The Potomac portion of the system can meet almost all of the WSSC needs, except for peak demands, leaving the Patuxent system as a supplement in times of low flow in the Potomac.

The Occoquan reservoir is located downstream from the WMA. It can store 10 billion gallons and has a safe yield of 55 mgd.³ The treatment plant capacity is 112 mgd. The system can be operated along with the Fairfax County Water Authority intake and treatment facility on the Potomac. The Little Seneca reservoir was constructed in 1985. It is the closest to the WMA, located upstream. Little Seneca was built to allow a margin of safety and flexibility in the system because its location allows it to correct errors in the releases from the other reservoirs. These errors occur because of the advanced time (4 to 5 days) that water must be released from upstream storages to meet demands in the WMA.

In the past, communities dependent upon the Potomac River for their water supplies have been subjected to the vagaries of the river with no assurances of being able to withdraw even subsistence amounts of water during some of the more protracted droughts. As a result, numerous studies of ways to ensure a more adequate supply of water for the various users have been conducted. In 1956, a study to determine the volume required for water storage for the WMA was conducted. That was followed by a proposal, in 1962, of how that storage could be provided.⁴ In 1963 after several studies conducted by the U.S. Corps of Engineers (COE) and by private consultants, a full development plan--the Baltimore District Engineers Report--was released. This report recommended 16 major and over 400 minor reservoirs.⁵ The plan was never implemented by Congress, however, because of intense local opposition.

In 1965, in response to a northeastern drought, the Northeast Water Supply Study was authorized. This study trimmed the number of reservoirs down to three in addition of Bloomington Lake: Little Capapon, Town Creek, and Sideling Hill. Then in 1968, the Corps of Engineers recommended three reservoirs in addition to the three proposed in the Northeast Study. These were the North Mountain, Verona, and Sixes Bridge reservoirs. Verona and Sixes Bridge were authorized in 1974 but local opposition to Sixes Bridge halted that project until evaluation could be made of a Pilot Estuary Water Treatment Plant and another study dealing with the WMA water supply.

In 1976, the Corps of Engineers initiated another study of the Verona and Sixes Bridge reservoirs for Congress. This "reformulation" study was designed to analyze the utilization of the reservoirs from a contemporary perspective, taking into account new cost allocation policies developed since the initial study was completed. The study suggested that interconnections could supply water needs through the year 2000,⁶ but the idea was dropped from the 1977 final report of the Northeast Water Supply Study because of the excessive operational costs associated with the interconnections.

Concurrent with the Corps studies, the two major water utilities in the WMA were planning improvements to help them meet expanding water supply needs. When the utilities, located upstream from the Corps of Engineers' intake, applied to the COE for the necessary permits for constructing in a navigable waterway, the COE insisted on some type of

agreement governing withdrawals during periods when insufficient water flowed to meet all of their demands. This was the spark for a Low Flow Allocation Agreement (LFAA) between these parties (explained in more detail below). Although Maryland, Virginia, and the two utilities objected to a provision in the ensuing LFAA allowing for a freeze on the water allocation formula in 1988, they did not pursue their objections in court because of the delay this would impose on obtaining needed COE permits.⁷ The LFAA was signed in 1978.

In 1977, a major drought severely depleted the storage in Virginia's Occoquan Reservoir. This prompted the application of risk analysis techniques to the storage levels in that reservoir.⁸ Multiple computer simulations were run using historical and generated streamflows as inputs. The elevation used for the water level in the reservoir was the actual value that existed at that time. The effect of the input streamflow on the water level in the reservoir was calculated. Twenty percent of the calculations showed a dry reservoir for 1977-78, suggesting a high probability of the reservoir running out of water during critical periods. It was agreed that a cutback in demand was necessary. The level of cutback to be chosen by local officials depended on the risk of creating a panic situation as well as on the risk of running out of water that the local officials were willing to accept. The local politicians decided that a 5% probability of running out of water was an acceptable risk. Efforts were made to cut consumption by the corresponding demand reduction of 8 mgd. The calculations showed that a demand reduction from 40 mgd to 32 mgd would reduce the risk of water shortage from 13% to 5%, so the local officials set out to accomplish that goal.

Although risk analysis techniques helped in the crisis situation, it was realized that this alone was not a long-range solution to the water supply problems the WMA was sure to face. As more people put demands on the same supply, the frequency of water supply difficulties would increase as well.

One of the agencies to follow up on this was the Interstate Commission on the Potomac River Basin (ICPRB), a forum for water management coordination. Although it had limited funds and authority, it was that organization's foresight that suggested the possibility of operating the Potomac River Basin's reservoir and river withdrawals in a coordinated fashion to minimize drought effects.

To test the theory, demand forecasts for the year 2000 were used and the supply deficit during a 90-day duration, 50-year drought was calculated. This was equal to the worst drought on record. When the results were compared with the total available storage, a resulting water surplus of nearly 5 billion gallons over the 90 day critical period was forecast. Thus it was determined that there was enough storage available to survive the worst expected drought even with the year 2000's projected population. Support for ICPRB's theory was widespread and enthusiastic.⁹ Furthermore, a COE study that showed the existing distribution systems and their normal operational upgrades would be sufficient to implement the regional operating concept for drought management. It was also concluded in the final Northeast Water Supply Study report that the reservoirs could be managed on a monthly basis as an alternative to daily manipulation. Accordingly, a sliding monthly schedule was recommended.

Development of a Regional Operating Strategy

The political subdivisions and agencies involved in the WMA water supply picture are Maryland, Virginia, the District of Columbia, the Corps of Engineers, and two major water suppliers: the Washington Suburban Sanitary Commission (serving Montgomery and Prince George Counties in Maryland) and the Fairfax County (Virginia) Water Authority. These parties recognized that much of the time there was not any particular difficulty in meeting the water supply needs of the Washington, D.C.-Maryland-Virginia area. During normal operating periods, each water supplier operating independently got along quite well. Only under critical conditions was it considered that some type of regional operating strategy would be needed. Accordingly, two conditions were defined and agreed upon, either of which would signal the need for joint action: 1) if the flow in the Potomac fell below 200% of expected withdrawals, or 2) if the probability of meeting all water requirements and refilling all reservoirs by the following June was below 98%.¹⁰ The joint action to be taken was embodied in two operating strategies: the Low Flow Allocation Agreement and the regional reservoir operating policy.

Low Flow Allocation Agreement

An important part of the regional water management plan for the WMA is the Potomac River Low Flow Allocation Agreement (LFAA). The parties involved are all those listed previously. In time of severe crisis when the regional operation of reservoirs is insufficient to offset water shortages, the LFAA defines the equitable distribution of water from the Potomac among all the users, including instream users. The COE pushed

for this agreement because its water supply intakes were located downstream from those of the other two major suppliers. The LFAA is designed to preserve each participant's right to basic water needs, which will all be met prior to meeting any non-essential needs. The Corps of Engineers uses a formula, to be unchanged after 1988, to calculate the volume allotted to each use. The COE is then responsible for informing each participant of the amount of water it is entitled to.

Determining instream needs. A provision of the LFAA is a requirement to meet the instream needs of the river during low flow periods. The job of defining those needs was assigned to Maryland, which assembled a task force comprised of the signatories of LFAA, the U.S. Geological Survey, the EPA, the Interstate Commission on the Potomac River Basin, the Potomac River Fisheries Commission, the U.S. Fish and Wildlife Service, and other State Agencies.¹¹ A portion of the study dealt with the effects of reduced flows on the downstream estuary, and the rest of the analysis was devoted to determining the effects upon a specific segment of the River nearer the WMA. Information about minimum flow-by and estuary impact from various governmental groups led to the decision that the impact on the estuary would be minimal and was not needing of further investigation.

The U.S. Fish and Wildlife's Instream Flow Group's incremental methodology computer model was used to assess the needs of aquatic life. The model "utilizes indicators of fish habitat availability, compared at different flows, to determine fish electivity curves for representative species and life stages at projected flows".¹² Data were collected and the model was calibrated. When the model was run, it became clear that

there was not one magic flow-by number that could be applied to the Potomac as a whole, but instead different values for several reaches of the river.

Study recommendations. The study recommended 100 mgd as the minimum flow-by over the Little Falls Dam¹³ in order that there be no irreparable damage to the downstream estuary. Another recommendation was designed to protect a fishery in need of greater than 100 mgd. To accomplish this, the Aqueduct withdrawal point upstream from the fishery would need to be shifted to the Little Falls intake located downstream when the river flow dipped below 500 mgd.¹⁴ This would protect the fishery by leaving the withdrawn amount in the river until after the fishery had been passed. A third study recommendation was for the development of a monthly flow schedule that would optimize instream values while meeting the water supply needs of the users. This was scheduled to be done when the Bloomington Lake reservoir was completed (in 1981).

The first two recommendations were unanimously accepted and recommended to the Corps of Engineers, who agreed to abide by them. The third was given the go-ahead for analysis and study by Maryland.

Reservoir Operating Policy

The other half of the WMA region's operating strategy involves managing the water supply sources as a single system. Intake structures and reservoirs in the WMA are operated regionally during critical drought periods in order to utilize the full potential of the existing reservoir storage.

<u>Function.</u> According to Sheer,¹⁵ the two short-run operating objectives for the river and reservoir management system are to "1) balance the daily flow and the daily demand including flow-by; and 2) balance the shortages in the reservoirs". The long-range operating objective is to "maintain storage sufficient to assure supply through the worst drought to be reasonably expected".

Methods are available to meet the short term goals. Among them are scheduled releases from upstream reservoirs. There is the lag time associated with the time it takes the water to reach downstream. This lag time can lead to large discrepancies between the estimated and the actual demand because of the imprecision of the forecasts. Another method involves the reservoir close to the WMA, the Little Seneca reser-This reservoir is used to dampen the variation between the voir. upstream releases and the downstream demand. Yet another method involves the ability of local systems to change the amount of withdrawal from the local reservoirs. Flexibility in local systems is the key. Demand restrictions are another method that may be used in order to reduce the demand variation and uncertainty that is otherwise found in any system. This method is also a commonly recognized means of accomplishing the long-range objective. Demand restrictions may be enacted along with or prior to voluntary water conservation measures designed to further reduce demand.

<u>Computer modeling as a regional reservoir operating tool.</u> Several computer models are key in managing the schedule of releases from the reservoirs. The USGS has developed a travel time model that helps predict the necessary flow to be released from upstream reservoirs. The Cooperative Water Supply Operations on the Potomac (CO-OP: created and

charged by the Interstate Commission on the Potomac River Basin with establishing an operation center for water supply management during drought) developed a crude demand model.¹⁶ The National Weather Service also developed a flow forecasting model with help from CO-OP that can be used for long-range predictions. This model incorporates the risk of not meeting the demand. It also calculates the antecedent soil moisture conditions that have been determined to play an integral role in the river flow.

As a test of the regional operating system, a trial drought was simulated. Each night, the utilities received an operating sheet for the following day that contained "a recommended additional upstream release, a predicted river flow, 5-day river flow prediction, predicted demands and recommended withdrawals".¹⁷ The utilities decided what withdrawals from the Potomac and the reservoirs were appropriate. An acceptable, small shortage in supply occurred because of variations between the simulated and predicted values of flow and demand. The trial helped to highlight the most sensitive parameters of the different models, and corrections were made to improve the models prior to experiencing an actual drought. Additionally, and perhaps even more importantly, the trial showed that management of the withdrawals from the river and the reservoirs could work with existing structures to meet the supply needs of the area during a drought. These drought tests have been conducted every year since.

Information from the computer models is used to determine the schedule of filling and release for each reservoir. This schedule is necessary to maintain adequate flow to meet the demand needs of the
public, as well as the instream needs of the river. The Washington Metropolitan Water Supply Task Force, created by Prince George and Montgomery Counties, has stated its confidence that the Low Flow Allocation Agreement will never need to be implemented as long as the system operates regionally, unless a drought two or three times more severe than experienced in the past occurs.¹⁸

<u>Analysis</u>

During periods when everyone's demands can be met from the river, each member acts independently. No authority has been forfeited during normal operations. No extra organizations were created for this venture. Organizationally, what occurred was that several states and water authorities agreed to work together during water supply crises for the good of all at a lower price than if they worked apart. The cost of projects that benefit all members are shared between them. For instance, because Bloomington and Little Seneca Reservoirs were built to help the entire region, all members in the agreement shared the cost of construction and maintenance.

It was the Corps of Engineers who expanded on the Interstate Commission on the Potomac River Basin's management theory to show that not only could the regional operating approach solve most of the water supply problems the area would be facing until well into the 21st century, but that this could be accomplished at a substantially lower cost than any other alternatives. Local utilities asked the ICPRB to help them work together to find an equitable solution. These negotiations were also helped by the neutral technical support of CO-OP: particularly with several hundred computer runs of cost-sharing alternatives.¹⁹ These three organizations aided the success of the regional venture by providing a forum for communication as well as technical information necessary for decision-making.

There was an unusual occurrence in that Maryland, Virginia, and the District of Colombia had mutual understanding and cooperation concerning the problems that the area was facing and the solutions that could be used to counter them. They recognized that they were all a part of not only the problem but of the solution as well. Aid in the negotiations was requested from the ICPRB. However, the WMA had a large head-start regarding the positive communication needed for the regional undertaking. The intense opposition to structural approaches showed that some new approach was needed. The area was receptive to new ideas.

The LFAA and the computer-run regional operating schedule for reservoirs were created to handle water shortage emergencies, but there are important environmental implications as well. The parties involved realized the importance of instream needs and defined the minimum flowby. In times of short supply, this flow-by is the first priority: only after this value is allotted are the other users in the stream allowed to divide the rest of the available supply between themselves.²⁰ Yet perhaps even more important is that the traditional, yet controversial, structural water management practices of building reservoirs and/or dams, and new source development gave way towards a primarily nonstructural management alternative.

The selection of a primarily operations management plan instead of a primarily structural solution to the water supply problems in the area was an idea whose time had come. Instead of 400 or even 16 reservoirs,

only 2 of those originally suggested were built. Bloomington Lake Reservoir was built in an economically depressed area where there was more support than opposition. Little Seneca was built at the site of a rejected Soil Conservation Service multi-purpose reservoir where local residents wanted a reservoir to keep high density development from occurring in their rural area.²¹ However, other government proposed sites for previous reservoirs had not had the same local support, and the outcries of local citizens in protest of additional dams and reservoirs were calmed by the non-structural agreement. Additionally, fisheries in the river, industry dependent on the estuary, and environmentalists were heartened by the concern for instream use displayed in the LFAA.

Utilization of existing facilities to their fullest potential is an intuitively pleasing concept that is not difficult in theory to sell, although resistance to the practicality or ability of simulations to predict flows and demands may be apparent in some instances. The trial simulations performed prior to implementation were sensible. They tested the validity of the model, soothed some of the lingering reservations that may have existed, and allowed for finer tuning of the models themselves by showing weak points. Until the models are tested by a real drought for the area, of course, it will be impossible to determine what unforeseen impacts have not been accounted for and how well the models work in a drought situation. However, like the simulations, a drought may help to further refine the models.

For the WMA, it is the first time since concern has existed that the water supply shortage problem seems to be adequately handled. Historically, the only approaches considered were structural solutions:

namely, building reservoirs. In 1963, over 400 reservoirs were being proposed to aid in the struggle of finding an acceptable way to meet the WMA's water supply needs during droughts, and in the future. However, in almost every instance where reservoirs were proposed the response was harsh criticism and opposition. Still, the only solution considered at that time was one that local citizens would not tolerate.

The ICPRB was the first with a new approach: meeting the supply needs through better management. Studies indicated that the available storage was sufficient; it was the independent management of reservoirs and withdrawals that was creating shortages. Contrary to precedent, a primarily non-structural management strategy was devised that utilized all of the existing facilities of the areas surrounding the WMA. With the results of several computer models, utility managers in the WMA were able to schedule their operations in harmony with each other and in a more nearly optimal manner. The result of working together instead of independently was effective utilization of the available facilities, and at a much less cost than other previously proposed solutions. The WMA's water supply problem appears to have been solved in this non-conventional manner: people there are assured that there will be an adequate supply of water for the foreseeable future.

<u>Notes</u>

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2. D. P. Sheer, "Assuring Water Supply for the Washington Metropolitan Area: Twenty Five Years of Progress," in <u>A 1980's View of Water</u> <u>Management in the Potomac River Basin</u>, Washington D.C., Committee Print, 97th Congress, 2d Session, 1981, p. 55.

3. Ibid., p. 57.

4. Ibid., p. 41.

5. Ibid., p. 41.

- 6. Ibid., p. 46.
- 7. Eastman, p. 63.
- 8. Sheer, p. 46.
- 9. Eastman, p. 64.
- 10. Ibid., p. 68.

11. C. A. Wheeler, "The Potomac River Low Flow Allocation Agreement and the Environmental Flow-By Study," in <u>A 1980's View of Water Management</u> <u>in the Potomac River Basin</u>, Washington D.C., Committee Print, 97th Congress, 2d Session, 1981, p. 21.

- 12. Ibid., p. 23.
- 13. Ibid., p. 24.
- 14. Ibid., p. 25.
- 15. Sheer, p. 57.

16. Ibid., p. 58.

17. Ibid., p. 60.

18. R. S. McGarry, "The Washington Metropolitan Water Supply Task Force," in <u>A 1980's View of Water Management in the Potomac River</u> <u>Basin</u>, Washington D.C., Committee Print, 97th Congress, 2d Session, 1981, p. 74.

- 19. Eastman, p. 67.
- 20. Wheeler, p. 24.
- 21. Eastman, p. 63.

CHAPTER 5 REGIONAL WATER AUTHORITIES OF ENGLAND AND WALES

Background

Years ago in England and Wales, as people began to come together to form villages, improper waste disposal techniques coupled with the lack of drinking water disinfection techniques led to disease outbreaks such as cholera and typhoid fever. In 1847 one of the eight water companies of that time, the Lamberth Water Company, changed its intake to a point on the Thames River above the London sewage outfall.¹ Six years later there was a severe cholera outbreak in London that the people served by this particular water company escaped, leading Dr. John Snow to conclude that cholera was waterborne. This realization led to more careful site selection as well as filtration of water supplies. In 1848 the first of nine acts concerned with preventing these outbreaks, the British Public Health Act, was passed.² Then in 1936, an updated Public Health Act was passed. This was one of the forerunners of the broadly scoped legislation for water management that exists today. That act combined statutes and gave local authorities the responsibility to handle their water supply, sewerage, and sewage disposal programs.³

Problems with these local arrangements emerged, however, usually associated with local water supply shortages. The inability of some areas to meet their water supply needs caused them to look beyond their boundaries, and the formation of water boards serving the water supply

needs of several smaller areas became a practice. Although water management continued to shift towards larger organizations covering broader areas, sewage disposal considerations prevailed at the local level.⁴

The rivers continued to be used as the means of sewage disposal. Intakes for a city's water supply were placed above its sewage outfalls, but the impacts of upstream outfalls and downstream intakes were not always considered. Some cities built reservoirs in unpolluted river catchment headwaters in order to receive a clean supply. The practicality of this solution was constrained, however, by the limited number of these catchments available as well as the great distances between many cities and these catchments.⁵ Based on these considerations, a better method of combating river pollution was believed to be necessary. Additionally, it was realized that separate management of the water intakes on the river could lead to overdrafts on the river during periods of low flow, and the depletion of aquifers below. The need for a broad-based management scheme was recognized.

The Water Act of 1945 and the Rivers Board Act of 1948 were perhaps the two most important pieces of legislation leading up to the largescale regionalization in 1974.⁶ The 1945 Act created a body called the Central Water Advisory Committee to advise the government on water related matters. The Act gave the Minister of Health the responsibility for overseeing water undertakings in England and Wales and the power to command local authorities or joint water boards to join together to supply water to areas inadequately serviced by smaller areas. The Minister used this power to regroup water suppliers, and their number dropped from almost 1200 in 1945 to 260 in 1968.

The 1948 River Boards Act created 32 river boards in England and Wales responsible for land drainage and flood control, navigation, fisheries, and pollution control: functions previously the responsibility of local authorities, catchment boards, and fisheries boards. Reorganization that took place prior to 1974 helped smooth the resistance to the 1978 Act.⁷

The Water Resources Act of 1963 addressed problems relating to river pollution and water supply withdrawals. The act created river authorities, very similar in area to the river boards, that were responsible for these two issues in addition to managing land drainage and fisheries functions: previously functions of the river boards. The 1963 Act combined executive power and responsibility in one body.⁸ The result was that water resources responsibilities were handled better by the river authorities than they had been previously but sewage concerns were still inadequately addressed.⁹ The 1963 Act also created the Water Resources Board (WRB) to collect information, coordinate river authorities' activities, and conduct water resources development planning. The WRB was the first to conduct comprehensive evaluations of water resources needs and collect data to address that end, but it was frustrated by its lack of jurisdiction over water quality and water pollution, which it said were imperative for competent water resources planning.¹⁰ All in all, the impacts of the Water Resources Act were not as dramatic as might have been hoped because the river authorities did not adequately enforce the act, combine the management any of the sewage facilities, or properly maintain the facilities.¹¹ The WRB also lacked sufficient authority over water resources matters.

To deal with the problems inherent in the 1963 Water Resources Act, the Water Act of 1973 was passed. The timing of this act was not arbitrary, but rather was intended to coincide with two other major reorganizations that were taking place: the reorganization of local authorities called for by the 1972 Local Government Act, and a health services reorganization: both of which were scheduled to take effect on April 1, 1974. The government felt that the reorganizations would be somewhat traumatic to local governments and hoped that the trauma would be minimized by having all of the reorganizations occur at the same time instead of one right after the other.¹²

The 1973 Act created ten autonomous water authorities in England and Wales, based on river basin area, that were responsible for the management of all components of the water cycle. Upon the act's implementation on April 1, 1974, "1393 sewerage authorities, 156 water undertakings managed by either joint boards or by local authorities, 32 water companies and 29 river authorities" were disbanded and replaced by 10 authorities¹³ (see Figure 5-1).

The bulk of information available about the water authorities of England and Wales primarily describes the authorities as they were at this time and for the majority of their existence. That is what is covered in this analysis. However, changes occurred after ten years of operation that must be mentioned for completeness.

After a change to a new, more conservative government in 1979, a new act was passed--the Water Act of 1983.¹⁴ This act made several changes that resulted in the water authorities becoming more economically efficient. The staff of the Thames Water Authority was reduced by over 75% with the remaining members to be appointed by the Central



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Areas in Wales within Severn Trent Water Area in England within Welsh Water

Figure 5-1. Water Authorities in England and Wales.

Government; and all authorities were pressured to reduce their staffs.¹⁵ Such functions as planning and operations were combined to help in accomplishing this goal. Consumer committees were established to represent the public in lieu of public representation in the authority structure itself. In addition, the authorities' meetings were closed to the public. Two groups established by the 1973 act--the National Water Council and the Water Space Amenity Commission--were disbanded.

Smoothing the Way for Regionalization

The wide-spread multifunctional regional approach that was proposed in 1973 generated widespread opposition. Many were concerned that sewerage functions held substantially lower priority than did water functions and would be neglected in the face of budgetary considerations. Others were afraid that system checks and balances would disappear as the accountable agency moved further out of reach.¹⁶

To help alleviate the public's concerns, the government published a series of 17 Consultation Papers. Each paper covered one questioned or controversial point of the proposed reorganization. In this manner, the government directed questions and criticisms concerning the reorganization away from the central issue and instead to specific points.¹⁷ The papers were intended to allow for public input, and nearly 3000 copies of each were distributed.¹⁸ One effect they did have was they "saturated the opposition by allowing little time for comment and little real dialogue".¹⁹

Infrastructure

While in existence between 1963 and 1974, the Water Resources Board reported that without additional source development, serious water problems might develop by the mid-1980's.²⁰ Some believed, however, that the water reorganization could help keep this from happening. It was believed that the new water authorities could help ensure a more wholesome supply because of their control over sewage and industrial disposal, which had previously lacked sufficient funding and monitoring. In addition, because water authorities (WA) effectively own all the water within their purview,²¹ they can develop sources in regions where supply is not a problem. However in practice, the WAs have left source development to the water supply companies and have not increased the infrastructure appreciably.

All public sewers, sewage disposal works, and water works owned by local authorities, or boards comprised of local authorities, in addition to the physical property, liabilities, and staff associated with the works became the property of the WAs. The local authorities kept their public health functions in regard to ensuring the quality of the water supply, and they maintained operational control over sewers and sewerage. Private water supply companies also continued in operation as agents of the WAs. The water authorities did little to add to the infrastructure in place prior to reorganization, notwithstanding standard system upgrades.

In 1976, the worst drought (since 1727) in recorded history of the U.K. occurred.²² After the drought ended, the National Water Council, an organization that advised the ten authorities on matters of mutual concern and provided common services such as training or salary

negotiations, reviewed the actions taken. The council decided that interconnecting water distribution lines to a greater extent than existed at that time was not economically justifiable. The council reasoned that conditions worse than the 1976 drought were not expected to occur often and the system reliability exhibited during the drought was sufficient.²³

Some figures related to the Thames Water Authority gives some idea of the infrastructure scale. The Thames Water Authority is the largest WA, serving 12 million people in a 5,000 square mile area.²⁴ Of the 500 million gallons per day supplied by the Thames Water Authority in the late 1970's, approximately 44% came from groundwater supplies and the rest came from the Thames River and its tributaries.²⁵ Several offstream pumped storage reservoirs located in the Thames and Lee Rivers (a major tributary) catchments stored a total of 46 billion gallons in 1978.²⁶ North of London there exists a tunnel between these two rivers such that flow can be diverted from one to the other if water storage or water quality conditions necessitate such action.

Function of Water Authorities

The water authorities perform thirteen specific functions: water conservation; water treatment, supply, and distribution; well monitoring and compliance with drinking water quality standards; the construction, operation, and maintenance of sanitary sewers; sewage treatment and sludge disposal; river management, including planning of discharges and withdrawals; regulation of discharge and waste disposal; sludge disposal; land drainage, flood protection, and sea defense; provision of

navigation; maintenance and development of fisheries; nature conservation; and amenity and recreation.²⁷ The provision of a water supply and the reclaiming or disposing of wastewater are seen to be the major functions of the WAs, while the other functions are to be taken into account during planning and operations.²⁸

Although the authorities are responsible for the specific functions listed above, the WAs are assisted by local and private enterprises. Private water companies survived implementation of the 1973 Water Act and still supply water to their service areas, although now under the responsibility of the water authorities.²⁹ In the Thames Water Authority alone, seven statutory water companies operating under the authority remain. These companies are controlled by the authority by means such as seasonal withdrawal limits, or withdrawal limits based on the flow in the river.³⁰ Similar to the Washington D.C. situation, the companies are allowed a certain volume per day withdrawal from the river as long as the flow over Teddington weir remains above 170 mgd, although in severe drought conditions all of the river water may be abstracted. 31 In addition to the allocation of some water functions, the collection, operation, and maintenance of local sewer systems are left for the local governments to perform, ³² along with the testing of public water supplies.³³ This is perhaps a carry-over from the earlier days of fragmented sewage systems that has not yet disappeared.

Management Form of Water Authorities

The ten water authorities created in 1973 are still in existence today. Their structure is not based upon political boundaries, but rather upon major watershed drainage areas. England and Wales operate

under a unitary governmental system, as do states in this country, where all governmental organizations are creatures of the central government to be created or disbanded at will. The relationship between various levels of government and the administration of water services is shown in Figure 5-2.

The central government retained several responsibilities in regard to WAs. The Secretary of State appoints the chairman for each WA and gives the WAs a general direction. The government imposes spending limits upon the authorities. The limits are based on the government's perception of "the effect of capital expenditures on charges and . . . what the market will stand".³⁴ In addition to the total expenditures the authorities are permitted to make, the proportion spent on the different main functions is determined by the government, as well as the rate of return--or other financial obligations--on a WAs investments. However, the details as to how the money for water supply, for example, will be spent are decided by the individual water authority. The water authorities report to the central government by way of annual reports and statements of their accounts.

Each WA has a different management structure, and the initial structure has changed considerably since 1973 in order to streamline the organizations. Before the 1973 Water Act was implemented, the government created a committee to study possible structures for the new organizations to assume. The report issued by the committee--"The New Water Industry Management and Structure", commonly called the Ogden Committee Report--supported an immediate multifunctional multidisciplinary management approach with different committees for different WA functions.³⁵



Figure 5-2. The Administration of the Water Services--Original Chain of Control. Developed from Okun (1977).

The major division recommended was the policy and resources committee. Its responsibilities would be the "corporate planning of water resources; (setting) priority objectives (for) planning; the formulation of water quality control policy; control and allocation of financial resources; levying charges; preparing annual estimates and capital investment programs; agency agreements; and relationships with the NWC [National Water Council] and local authorities".³⁶

The recommended quality advisory panel within the WA would be responsible for analyzing the WA's performance relating to water, sewage, and river management. However there was concern about having the WAs responsible for monitoring their own progress. In order to separate the quality advisory panel and the WA it was analyzing, the Report recommended that the panel should not operate under the control of any committee, but should instead gets its authority directly from the WA.³⁷ By not being responsible to anyone within the WA, the panel could serve the public without fear of WA repercussion. Also, this separation would help to alleviate some of the difficulties found from the WAs regulating themselves by making the management group and the monitoring and compliance group more like two separate entities.

The report also recommended committees on water management, fisheries, and regional and area land drainage. The water management committee would consider the whole hydrologic cycle from water conservation to water supply to sewage disposal. Additionally, this committee would handle relations with private water companies or local authorities acting as operators of WA facilities. The fisheries committee and land drainage committees were statutory requirements. The Report recommended combining the fisheries committee and an amenity and recreation

committee together, and soliciting public input from aware citizens, such as local advisory committees, who were very knowledgeable about the issues of concern. 38

Drought Management

The current drought management legislation was passed as the Drought Act of 1976, which was implemented while the 1976 drought condition was already serious. 39 This act kept a previous act's less severe drought restrictions on lawn watering and car washing. These non-essential uses are restricted in drought orders as authorized in Section I of the act during the time when the drought is still forming and does not yet create an emergency situation. Drought orders from Section II of the act were created for severe or emergency drought conditions, and are implemented for up to a six month period. This section provides the authorities with the means to prioritize economic activities and public services and to distribute the available water as needed for continuous employment, manufacturing capabilities, and other valued Water may be discontinued to facilities such as swimming enterprises. pools that are not deemed important to the economy.⁴⁰

The measures taken during the 1976 drought were drastic. To increase the supply, several abandoned groundwater wells were brought back into service. Some distribution systems were interconnected to keep distribution capabilities from becoming the limiting water supply factor. To increase the flow at water intake structures in the Thames, the Thames Water Authority backpumped over the weirs.⁴¹ This utilized water that had been lost in the navigation locks and water that had

flowed into the Thames from tributaries entering the river below the last intake structures. All the water from the Thames was utilized and no fresh water flowed into the estuary. Over 2.5 million gallons of wastewater treatment plant effluent was used for watering grass that had been deprived of its potable supply.⁴²

In order to reduce demand, the water authorities used pressure reductions in the distribution system in conjunction with efforts to detect waste. An appeal was also made to the private sector for voluntary demand reductions. These efforts resulted in an estimated 25% maximum reduction on normal demand.⁴³

Financing

Water supply is considered differently in England and Wales than it is in this country. Throughout their history, the English and Welsh have considered water supply as a public health necessity: not a commodity to be bought and sold. With the inception of water authorities, this attitude has begun to change. For the first time, water rates reflect more closely public usage instead of the government providing water basically free.⁴⁴ The new principles regarding financing of water services are "that the services must pay for themselves, and that a service should be offered only if its benefits exceed its costs".⁴⁵ Public health needs are the only commonly accepted exception.

Users of the system finance all operations of water authorities in England and Wales with the exceptions of treasury grants for rural services and funds for land drainage. The charges for the WAs' services were initially based on property values, and each WA had the option of combining charges for all services or charging for each independently.⁴⁶

For example to calculate sewage rates for a residence, the Thames Water Authority multiplies the total sewage expenses to be covered with the residence's property value and divides by the total property value in the authority. Industrial effluent is charged according to the strength and volume of the effluent as it relates to the plant's conditions.⁴⁷ To help set water rates WAs can install water meters, if the WA has shown the government that it is appropriate. The government is sometimes available for authorities to borrow funds from, but the money is repaid.⁴⁸ As mentioned previously, the government determines the amount of money to be spent annually by each authority as well as the percentage breakdown for each specific duty.

<u>Analysis</u>

The importance the Water Act of 1963 to the success of 1973 Act should not be neglected. The 1963 act created the Water Resources Board which conducted "the first comprehensive examination of water resources needs and prospects for meeting those needs in England and Wales".⁴⁹ In addition, the WRB institutionalized data collection. This is important because knowing what the water needs are and the opportunities for meeting needs is imperative for any successful water manager. The WRB studies gave a solid foundation upon which to build a broader regional authority than already existed. Another positive impact of the 1963 Act was in the creation of river authorities. Although the success of these authorities was somewhat limited, the river authorities operated as short-lived true multifunctional agencies. The shortcomings of the river authorities were theoretically done away with when they were

reorganized into the water authorities. Additionally, the river authorities supplied highly competent personnel to the new WAs.⁵⁰ Lastly, the 1963 act helped to bridge the large gap between "clean" and "dirty" water personnel by assigning both duties to the same agency.

Water authorities needed to develop favorable relations with the local authorities under their control in order to be successful. Although responsibility for sewerage and sewage disposal belonged to the new WAs, they were required to work together because the local authorities maintained the implementation authority over sewerage functions. In addition, public health functions--such as testing to ensure a good quality water supply--were kept by the local authorities. Several factors have been identified that contributed to the cooperation that indeed developed.⁵¹ First, the majority of each WA's members were appointed from local authorities. Second, the local authorities acted as agents for sewerage discharge functions for the WAs. Third, various authorities provided goods and services to one another, and fourth, there were now better arrangements for emergencies and disasters than existed previously.

Since consumer services changed along with the changing water management scheme, it is hard to determine if the reorganization increased the efficiency of the system and provided better services for the same or less money. In Oxford the rates went up after reorganization to help the people in the surrounding areas. However, Oxford residents did not complain because their service continued to be good and they understood and supported the needs of regional water management.⁵²

In earlier days, the river authorities believed it was unethical to use water charges as a rationing device, 53 and that has never been the

intent. However the combination of charges for sewage outfalls and an increase in the price of water has resulted in a noticeable decrease in industrial water use by users of the Oxford sewerage system. This has extended the useful life of the water supply system by delaying the time until capacity will be reached.⁵⁴

Criticisms of the reorganization by local governments have centered on the difficulties the governments were having. Small, poorly operating authorities were difficult to incorporate into larger structures. Guidance concerning staffing and policy for long-range programs was scarce; and a lack of modern laboratory equipment existed at many stations. Relations between district and county councils were strained when considering county approval of district proposals; and other difficulties existed between local governments and WAs concerning sewerage agency agreements. The last concern expressed by the local governments was the inability of larger local governments to attract qualified staff after many of the most valuable personnel, in the face of reorganization, left an uncertain future with the local authorities for more stable positions elsewhere.⁵⁵

A potential new problem was created by the reorganization. Historically, strikes have not been an uncommon response to labor difficulties. There is the possibility that, by combining all the labor forces, a much more powerful labor union might form. If so, a strike could cause much more substantial damage than was possible while the organizations remained fragmented.⁵⁶

Some problems in England and Wales have decreased due to the regional arrangement and some have increased. The rivers are cleaner.

Enough water is available for everyone. Because widespread growth is not occurring any demand increases for water supply should be attributable to increases in the standard of living. A problem has been the initial rate increases experienced by customers. In Wales, the rates went up over 400%.⁵⁷ Part of this was increases that were due anyway, part was overhead for the WAs, and part was for the large staff the WAs maintained in order to dismiss as few employees as possible in the transition. The 1983 Act was designed to streamline operations and reduce some operationally unnecessary overhead. Since that time, further changes have been pursued. A recent movement would privatize the regional water authorities to achieve a balance between effective private enterprise and reasonable public regulation, and to produce cost effective management.⁵⁸ The water supply and sewerage functions of the WAs would be transferred to utility companies, which in turn would be sold to private investors. If this occurs, the central government will need to surrender control over financing and personnel.

<u>Notes</u>

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2. D. C. Musgrave, "The Evolution of Integrated Water Management in the U.K.", in <u>The Thames/Potomac Seminars</u>, Rockville, MD, Publication 79-2, Interstate Commission on the Potomac River Basin, July 1979, p. 16.

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4. Ibid., p. 16.

5. Ibid., p. 17.

6. D. A. Okun, <u>Regionalization of Water Management</u>. <u>A Revolution in</u> <u>England and Wales</u>, Essex, England: Applied Science Publishers LTD, 1977, p. 18.

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- 18. Ibid., p. 51.
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26. Ibid.

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28. Okun, Regionalization, p. 48.

29. Musgrave, p. 17.

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CHAPTER 6 REGIONAL SOLUTIONS FOR IMPROVED WATER MANAGEMENT: EXPERIENCE GAINED AND LESSONS LEARNED

Analysis of regional water authorities in various stages of formation and operation discloses some common elements, suggesting that the transferability of regional approaches is both feasible and practical.

Benefits Associated with Regional Water Supply Management

The first and foremost lesson is that water supply regionalization must truly benefit all members of the regional organization, and should be cost effective. A basic premise of regionalization is that everyone should win: or at least stay even. By the rules of fair play and equity, no one should be forced to participate in a program that exploits one for the benefit of another. If participants are dissatisfied with their role in a regional venture, then the regional organization is likely to be doomed to an existence of ineffectiveness due to mistrust, resentment, and non-cooperation. However, if a RWSAs members support the authority's functions and operations because the regional venture is cost effective, the region will experience benefits attributable to the regional management approach.

Environmental Benefits

The efforts of regional water supply authorities to coordinate water supply management in Florida have helped to solve water quality problems. A major problem has been saltwater intrusion, which has both

threatened and contaminated some coastal aquifers. Moving water withdrawals inland to less environmentally sensitive areas has forestalled intrusion and removed some fear of source contamination.

Another positive environmental outcome is demonstrated by the West Coast Regional Water Supply Authority (WCRWSA) and its extensive monitoring and field surveying. The authority uses its well systems and interconnections to maintain the water levels in aquifers at acceptable levels for water supply purposes and also for vegetation and wildlife. The surveys determine if there has been change in the vegetation of a wellfield. If a change is noticed, the WCRWSA attempts to define the cause of the change. If wellfield withdrawals are determined to be straining the environment, the water can be removed instead from another wellfield that is not experiencing the same level of difficulty.

In England and Wales, the regionalization of water supply and sewerage has led to cleaner rivers. Although the majority of the benefit can be attributed to effective sewerage management, the concern about drinking water quality is what initiated this proper management to occur. It is the job of a quality advisory panel within the authority structure to comment on the authority's performance. This measure helps to insure that the authority meets its effluent discharge standards.

Sufficient Supply

A regional water supply authority can effectively deal with water supply quantity problems because there should be enough water within its boundaries to satisfy the region's entire population. The authority can distribute the water as it is needed. In Florida, the rights of members with a large water supply are protected by the inability of the RWSA to

take water that is already being put to a reasonable and beneficial use in one location and move it to another. The coastal areas have typically been the ones with supply shortages. Regional authorities have helped ensure that those growing and developing regions will have a water supply, while at the same time preserving rights of inland communities to continue to use their water.

In Washington D.C., the water supply question was solved by regional management of reservoirs. Although there is sufficient storage in the WMA to meet the needs of the area for many years, that can be realized only if all the water suppliers act together regionally. This is a dramatic example of how effective regional management can be. Without greatly increasing the structural system, the problem of water shortages was solved for the foreseeable future. The only necessary element that had been lacking was that each operator act with full knowledge of what was occurring in the rest of the system.

Motivating Factors

Supply Considerations

From study results predicting build-out for some areas in as little as three years, the Northwest Florida Water Management District knew that action was necessary to keep a severe crisis from developing in Walton, Okaloosa, and Santa Rosa Counties. The district's foresight fostered creation of a regional authority there before a crisis was experienced. However, it was the concern about the ability to meet daily water demands either during normal operations or during droughts that initialized local momentum. The local governments would not take action until they were convinced that their water supply was in

jeopardy. This has been the case not only in northwest Florida, but in other Florida regions as well. A drought provided the initial momentum behind the formation of the Peace River-Manasota RWSA as well. The WCRWSA had already reached crisis stages in some areas prior to beginning negotiations for the authority.

In the case of the Washington Metropolitan Area, the area was growing too fast for the water managers to keep pace. Droughts in the WMA helped bring a clear focus on the water supply issue that was often mentioned but never handled, because their severity was a reminder that the time for casual consideration was over and the time for concrete plan of action had arrived.

England has led the United States in the area of consolidating utility functions. Prior to the Water Act of 1945, local water suppliers had been banding together to serve larger areas than could be handled separately: the step that still causes difficulty in the U.S. Neglect of sewerage functions and subsequent severe river pollution finally alerted England that quantity was not the only water supply issue. They realized that larger-scale consolidation was necessary in order to protect the quality of the water supply.

The lesson here is one of foresight. Studies need to be conducted and the water supply situation must be determined before a crisis develops. Local governments need to be aware of the limitations of their own sources; however, there needs to be awareness of a regional picture as well. When deciding the appropriate area for a regional approach there is no set rule. However, an appropriate area is one that can meet the water supply needs within it economically. When the larger picture is

considered, local governments will almost certainly need aid from other agencies or organizations.

Assistance From Other Agencies

Local governments commonly need technical and/or monetary support in order to broaden their management scope. The limited resources available to smaller governments will often be prohibitive, even with the earnest desire to regionalize. A larger organization, such as the water management districts in Florida, may be necessary to set the stage for regionalization. If the public lacks awareness about the region's water supply problems, this organization must educate them about the problems and the possible solutions. Deliberate timing can be of assistance. For example, the SWFWMD began its intensive pro-regional campaign soon after the drought in the Peace River-Manasota region. The district utilized the increased public awareness the drought created to convince the locals that a solution was needed.

Local governments have to be convinced that a regional approach is beneficial to all involved. They must fully understand their role in the regional organization: what they have to do and what they will receive in return. Ideally, economics would tell whether par-ticipation was beneficial. However, although, for instance, economies of scale may beneficially impact the cost of a regional water supply facility, the charges to the consumer may still increase. This may be due to charges for additional services, such as environmental protection, that were not previously considered. After an authority is in operation, extensive public education campaigns are necessary and advisable to keep customers aware of how the rates reflect the services provided.

Arbitrating Intergovernmental Disputes

Of the five regional authorities considered in this study, both the participants in England and Wales and in the Peace River-Manasota region had somewhat favorable relations developed prior to regionalization. The Walton/Okaloosa/Santa Rosa and Washington D.C. regions did not have much of a working relationship, and the West Coast Regional Water Supply Authority member relations were poor. Although willingness of the participants may not be an absolute prerequisite for regionalization to occur, it is unlikely that any type of regional institution will be implemented unless adversary positions can be overcome.

The relationships between the members of the West Coast Regional Water Supply Authority (WCRWSA) were so bad that legislative interference was necessary to force the region to cooperate. After its formulation, the WCRWSA helped to bring order to the chaotic "water wars" situation. However, there is continued dissension because members have not been able to fully trust the authority. There is still possessiveness concerning the regional water supply. There still exists some hesitancy to accept the notion of 'good for the group' as opposed to the individual. This is not keeping the Authority from doing its job, but at times it makes it more difficult and protracted.

The Walton/Okaloosa/Santa Rosa Regional Utility Authority is another example where the decision to regionalize was made by the state government. The authority's members were initially uncooperative with the NWFWMD in its efforts to educate and aid the region in its imminent water supply problems because they were not convinced that the problems were as threatening as they were being portrayed. This belief constrained the formation of the regional authority for many years. When

the region finally got serious, it turned to the NWFWMD for monetary, technical, and policy support. It is too soon to tell if harmony will prevail because the authority is relatively new. However, two factors work in favor of success: the NWFWMD's continued guidance and support, and the fact that no member forfeited any water supply by joining.

A lesson from the formation of the Peace River-Manasota Regional Water Supply Authority is that even with a basic concern for the future of the water supply, it took time and effort from the SWFWMD to convince the region that a regional approach was a good solution to the problems they were facing. It is doubtful that regionalization would have occurred without the district's efforts because the region relied so heavily upon its technical and financial assistance.

The same is true for the Washington D.C. area. People were concerned about the vulnerability of the water supply during droughts, but no acceptable solutions arose. The Interstate Commission on the Potomac River Basin, the Corps of Engineers, and local water suppliers were all important in providing technical support to the area and for developing the regional reservoir management approach. The ICPRB was also instrumental in aiding the regional participants through negotiations.

In England, there are several reasons why a cooperative relationship developed between the authorities and the local governments. First, the majority of each water authority's (WA) members were appointed from local authorities. This satisfied the locals wanting to retain their voice. Second, the local authorities maintained responsibility by acting as agents for the sewage discharge functions of the WAs. Third, various authorities provided goods and services to one another,

promoting favorable relations; and fourth, there were now better arrangements for emergencies and disasters than existed previously.

Negotiation is a key element in the formation of a regional water authority. Whether favorable relations already exist or the region is in an uproar, neutral mediators are needed to facilitate an equitable arrangement. It is equally important that a forum continues after formation of the authority for continued input, debate, problem solving, and information. This satisfies the need and right of local governments to discuss their concerns about the regional arrangement.

Financing

Financing is a major issue that is at the heart of some difficult negotiations. In order to satisfy the majority of the members of an authority, it is best that each member's costs reflects the proportion of the benefits received. Unfortunately, it may be difficult to quantify all of the benefits involved. The costs and benefits derived from reduced river pollution, increased supply stability, or other such intangibles may need to be distributed over the entire region. On the other hand, benefits such as additional source development or the development of transmission or distribution systems are more easily associated with particular members. The vast majority of local officials and RWSAs support user financing for new facilities and daily operations. Capital for start-up operations may need to come from government sources or from member contributions. If member contribution is chosen, the charge to each may not directly reflect the expected benefits because the benefits cannot be precisely defined prior to

initial operations. Instead, contributions have commonly been defined in terms of population.

An exception to support for strict user-financing is the system in England and Wales. Rates went up dramatically after regionalization. Many of the benefits went directly to outlying urban areas, while the cities paid the majority of the cost. Reports show that urban residents were satisfied with this arrangement because of the understanding they had of the philosophy of regionalization. Such harmony, if it actually exists, is sorely lacking in the United States. No mention is given of the persuasive techniques that must have been employed to create such amity, but pursuit of this may be worthwhile.

Supply and Regulation by the Same Authority

All management levels in Florida have expressed their concern over the ability of a RWSA to effectively manage water supply for the same area it regulates. Floridians believe it would be a conflict of interest for districts to act as RWSAs and issue consumptive use permits to themselves. "Putting the fox in the henhouse" is a valid phrase that surfaces in discussions about this issue. However, in Florida, the Department of Environmental Regulation has the power of review over permits. In any case where there is belief that a district may not be acting appropriately in issuing or denying a permit, the decision can be appealed to the DER which reviews and ultimately decides upon the permit's fate. This check on the districts helps to keep any such abuse of power from occurring.

A similar concern was expressed in England while the water authorities were under review prior to their formation. The authorities were to be responsible for their own sewage discharges and also responsible for insuring that the discharges met applicable standards. The concern there was that there was no real incentive for proper sewerage maintenance since an authority's outfalls were usually located downstream from their water supply intakes. The solution in England was to have the water quality review panel's sole objective be that the river quality did not deteriorate. Local governments are responsible for testing the water supply, e.g. the rivers, and they therefore serve as watchdogs to insure that the water authorities and review panels are doing their jobs.

Once the choice for regional water supply management has been made, that choice may involve an agency with regulatory authority over the supply as well. In this situation, the popular choice has been to put some sort of check upon its operations. In Florida this check has taken the form of a review process to investigate claims of abuse of authority. Another option is to have a separate agency or local group act as a monitor of the regulatory agency, as is the case in England.

The Appropriate Level of Involvement for Regional Water Suppliers

The appropriate level of involvement a regional water supply authority should have relating to water supply is another issue where questions arise. A RWSA could go as far as fixing broken water lines, or it could stop at only developing facilities and let county or city officials handle the more routine aspects of water supply. County and local officials in every region are very concerned about forfeiting power: they want to keep local aspects local. The facilities and personnel that maintain local water system are already available.
Instead of displacing workers, a RWSA could either let the local operators in the area handle the maintenance aspects of water supply, or incorporate agencies or utility divisions into its own structure. Either way, there will be local help available for quick emergency response: the level of common and emergency service must not decrease.

In Florida, many WMD personnel are wary of becoming water suppliers. They are not eager to commit to a level of responsibility that leads consumers with dry taps to call them. The utilization of competent local personnel instead is an acceptable alternative. Additionally, local governments are eager to maintain some of their previous functions, and therefore, if they have demonstrated competence it may be advisable to allow them local control over their facilities. Then the RWSAs can concentrate on policy and management. On the other hand, however, WMDs often have the staff, the concern, the expertise, and the financial backing that could make them effective water supply managers. All the factors in any particular case should be carefully weighed to arrive at a suitable solution.

Conditions Under Which Regional Management May Be Appropriate

Regional water supply management can be an appropriate and effective solution to water supply shortages and crises. However, it is not necessary that the entire nation be divided into some number of regional authorities. Certain conditions lend themselves to a regional solution more than others.

First, the region should have some problems supplying water to its people. One goal of regionalizing is to more closely match the geographical distribution of water and users. If there is already

enough water for the present and future, there may be no need for regional management. However, background studies--such as supply and demand studies and forecasts--and detailed reviews of existing facilities are necessary for this determination. As occurred in the Washington D.C. area, it may be that a primarily non-structural strategy could be devised where regional operations management leading to full utilization of the existing facilities can alone meet the region's water supply needs. Such an approach that utilizes existing facilities to their fullest potential is intuitively pleasing and easy to sell, as compared to more costly, structural solutions.

Once the need for regional water supply has been determined, the attitudes of the potential participants should be surveyed. If they are amenable to a regional solution, negotiations can begin immediately. If the more likely scenario exists where there is some dissension between the participants, it may be wise to begin with extensive public information campaigns to create awareness about the problems and issues, and the approaches available for solving. Several solutions can be proposed for debate. If regionalization is not the preferred method, the other options should be given further consideration. It may be advisable to present several options and let the participants reach their own conclusion regarding regionalization.

If regionalization is chosen, it is necessary to have financial backing for start-up and initial operations. Capital can come from contributions from the members, from taxes, from selling bonds, from some government agency, or from other sources. Once the authority is in full operation, however, it should become self-supporting.

CHAPTER 7 CONCLUSIONS AND RECOMMENDATIONS

<u>Conclusions</u>

On the basis of case studies of RWSAs, and interviews with individuals knowledgeable about regional water management, several conclusions emerge.

 Political jurisdictions (boundaries) often limit the ability of governmental units to deal effectively with water supply needs.
 Hydrologic boundaries and political boundaries are often very different.

2. Potable water supply needs in Florida are being met by the actions of independent local governments, regional water supply authorities, and by inter-governmental arrangements in which one unit of government contracts with another for the sale and delivery of some of its treated water.

3. Institutions for managing water supplies range from formal broad-based authorities to ad hoc agreements on regional policies for operating water supply systems.

4. The nature of potable water supply arrangements is strongly influenced by circumstances. What works well in one case might not work well in another. Furthermore, the scale of the problem, local resources available, number of jurisdictions involved, and other elements must be factored into the solution.

 In general, water supply problems transcend political boundaries, and where large populations are involved, optimal solutions are unlikely to result outside of some type of regional structure. The nature of this arrangement can take many dimensions.
 In Florida, there is continued debate over the appropriateness of local vs. multi-county vs. water management district control over water resources and water resource planning.

7. The water management districts have not acted as regional water suppliers, or direct actors in potable water supply, except for some isolated short-term arrangements. This has been due to statutory prohibitions and the general philosophy that potable water supply management should be the responsibility of local governments.

8. The water management districts have played a major role in bringing about workable regional solutions to water supply problems. They have provided technical advice; acted as mediators in disputes; helped finance start-up operations; and have carried out educational programs to inform citizens of the pros and cons of regional water supply management.

9. The key to successful regional ventures is understanding the problem and devising incentives for all affected parties to participate.

10. Regional solutions to water supply problems in Florida have been somewhat limited in scope (through 1986) in that they tend to focus almost entirely on traditional source development and overlook more comprehensive approaches such as using renovated or saline waters, devising optimal systems operating policies, and

exploring the efficacy of improved management through system element linkages.

11. The example of the Potomac River Basin demonstrates the efficacy of optimal systems management as a solution to an area's water supply problems.

12. Water availability is not always the limiting factor in solving water supply problems, nor is technology; it is often the difficulty people have cooperating that creates the crisis scenario. Accordingly, a major element to be reckoned with in water supply planning is that of creating a forum in which issues can be addressed, compromises struck and implementable plans devised before fractionated proposals emerge with their resultant battle lines separating opposing factions.

13. There is a need for all governmental levels to continue educational programs. People in areas likely to experience severe water supply shortages should be well advised so that appropriate management measures can be taken.

14. Financing regional water supply systems can be troublesome, especially during start-up when the system has not had the opportunity to generate revenue. Under such circumstances, outside governmental help might be warranted. In general, the user-pays principle should be applied and revenues generated from the sale of water to customers should be used to recover costs.

15. Regional management has the potential to forestall environmental degradation. Water quality protection programs should be implemented in conjunction with water supply plans. In Florida, the water management districts are an appropriate focal point for centralized offices to coordinate quality protection efforts. 16. The 1987 amendments to Chapter 373 permit Florida's water management districts to serve as regional water suppliers and charge them with aiding local governments in planning for water supply and with carrying out water supply programs. Unless no other options are open for meeting an area's water supply needs, however, it would seem that the districts should not become direct suppliers of water.

17. Local government organizations are generally extremely concerned with retaining some level of control over their water services. That there be some means of accountability of the regional authority to the customers is also of major concern.
18. The situation in England and Wales demonstrated the possibility of combining all hydrologic aspects of water supply, such as supply, distribution, wastewater treatment, flood control, etc., in a multi-functional agency. This arrangement provides a forum for greater consideration of all of the factors influencing water supply without the need to coordinate several different agencies.

Recommendations

Based on this analysis of regional water supply institutions and of the problems associated with providing adequate quantities of potable water to communities of varying scale, the following recommendations are made:

1. Potable water supply should be the responsibility of the lowest level of government (city, county, RWSA, WMD, etc.) having: the authority to develop the necessary water supply sources and transport the raw water to treatment locations; the ability to finance system elements; the competence to plan and design comprehensive water supply systems; and the resources to properly operate and maintain the system.

2. Regional water availability and water use studies should be conducted by water management districts or state government agencies on a continuing basis. These studies would serve as the basis for forecasting water demands and for developing alternative strategies for meeting water supply needs.

3. State and local governmental units should assess institutional options for water supply management within their regions and facilitate the establishment of special management vehicles, such as RWSAs, if it is determined that they are needed.

4. The government agencies responsible for regulating water supply should assess the potential for conflicts related to the provision of potable water supplies within their regions and in-so-for as it is possible, take steps to see that they do not occur.

5. Mediation strategies should be included in water supply decision making processes. Disputes surrounding regional water supply management may be expected to occur, and if a neutral arbitrator is available that has technical competence and understanding of the political and social climate of its region, it can greatly aid the negotiations. All levels of government should continue and expand their educational programs, placing special emphasis on acquainting citizens with the pros and cons of cooperative regional water supply ventures when such arrangements appear to be warranted.
 State or regional governments should review their approaches to local government assistance in water supply planning and evaluate the adequacy of their data bases to support such planning.
 Users should pay the costs of regional water supply systems, but financial assistance by others, especially at start-up, might be necessary.

9. Economics should be an important consideration, if not a prerequisite, to regionalization taking place.

10. Alternative sources of water, such as reclaimed water, brackish water, etc. should be considered in developing options for meeting potable water demands.

11. Regional water supply management structures should be developed on a case-by-case basis. What is best under one set of circumstances is not always best under others.

12. Regional solutions to water supply problems should be considered in all planning processes designed to meet future water supply needs. This would assure that all options were explored, and that where a regional solution would be best, it would be given full consideration. It does not imply, however, that regional approaches should always be taken.

APPENDIX PERSONAL INTERVIEWS

Procedure and Questions

As a major portion of learning the views of city and county personnel, several personal interviews were held. These interviews were with RWSA directors in Florida, water management district personnel, and local officials in Broward County, Florida. Broward County was at that time in the progress of 'regionalizing' the cities' water supply systems into a county system to offset water supply shortages in the coastal areas caused by salt water intrusion.

A generalized list of questions that dealt with all major issues was created. Only the questions of pertinence to each interview were asked. The interviews were tape recorded. Discussions led different ways in each interview, however, the following list contains common questions.

1. What are the histories of established RWSA's? What elements were brought together? How? Why? When?

2. What form do regional water supply authorities in the state assume? What is the: method of representation? breakdown of authority? function of the executive director?

3. How do functioning RWSAs finance their activities: originally and now?

4. What function do RWSAs in Florida perform? How well are they functioning?

5. What hardware and infrastructure was needed to begin operations originally?

6. What were the systems in place prior to regionalization? Which were the most important?

7. If the systems have been interconnected, are the interconnections being regularly used?

8. What are the successes; problems; and failures associated with regional authorities?

9. What different options are available for RWSAs?

10. What is/has been/should be the role of the water management districts?

11. Is a regional approach appropriate?

12. What level of government should best handle water supply? Why?

13. What might be used to bring (people together/ you in)?

14. How will regionalizing the management of water supply help to solve quantity and quality water supply problems?

15. What doubts do people have about implementation of a regional water supply plan?

16. What elements should a good water supply plan for an area include?

17. How adequate is the available water supply?

18. How do a wellfield protection plan and a regional water supply plan work together?

19. What are the abilities and limitation of different levels of government to handle protection of water supplies?

20. How are the infrastructure needs to be defined?

21. What are the financing options? What are the pros and cons of each?

22. Who should handle the infrastructure problem?

23. What are the abilities and limitations of various governmental units to handle infrastructure problems?

24. Who should pay, and how?

People Interviewed

1. Degrove, John, Member of the Faculty and Administrator FAU-FIU, personal interview on January 29, 1987.

2. Emery, Scott H., Director of Environmental Services, West Coast Regional Water Supply Authority, personal interview on March 25, 1987.

3. Falck, Walter, Executive Director Broward County League of Cities, personal interview on April 1, 1987.

4. Flannigan, Charles, Mayor of Pembroke Pines, Broward County Florida, personal interview on April 2, 1987.

5. Hole, Stanley, Chairman of South Florida Water Management District Governing Board, meeting on December 9, 1986, not recorded.

6. Judge, Michael, Water Supply Advisory Board County Staff Liason, personal interview on January 29, 1987.

7. Mann, James, SWFWMD, liason with Peace River-Manasota RWSA and Withlacoochee Regional Water Supply Authority, personal interview on November 20, 1986.

8. McWilliams, Richard, Staff Member of the Northwest Florida Water Management District, in a personal interview on April 14, 1987.

9. Owen, Richard, South West Florida Water Management District, phone interview on November 4, 1986.

10. Poitier, Sylvia, Broward County Commissioner, personal interview on January 28, 1987.

11. Reynolds, Roy, Director of the Broward County Water Resource Management Division, personal interview on January 29, 1987.

12. Rist, Carol, Vice President Kendall Plastics, Ex. President of League of Women Voters, personal interview in March 1987, not recorded.

13. Rosenburg, Sunny, Mayor Hallandale, Broward County, in a personal interview on April 2, 1987.

14. Shair, Robert, Broward County Wellfield Protection Officer, personal interview on January 29, 1987.

15. Veltri, Frank, Mayor of Plantation, Broward County, Florida, personal interview on April 1, 1987, permission to record denied.

16. Vergara, E.D., Director Peace River-Manasota RWSA, personal interview on March 27, 1987.

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BIOGRAPHICAL SKETCH

Ellen Jessica Godreau was born in Sacramento, California, on April 26, 1963, to Edmond Charles Godreau and Lynn Martha Wadley. She has two older sisters, Adrien Seaton and Karen Godreau, and an older brother, Chris. The family moved to Connecticut in 1969. Jessica graduated as valedictorian of the Bolton High School Class of 1981. After one year at the University of Connecticut, she transferred to the University of Florida where she majored in environmental engineering. She received a Bachelor of Science degree in 1986. Her interest in water resources led her to study environmental engineering in graduate school, also at the University of Florida. She will receive a Master of Engineering degree in April 1988. After graduation, Jessica and her fiancee Stewart Wayne Miles plan to begin their professional careers and their life together in Raleigh, North Carolina.