LEGAL CONCEPTS IN WATER MANAGEMENT: SHAPING THE LAW TO SERVE THE PUBLIC INTEREST

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"O for an engine to keep back all clocks."
Ben Johnson

In this era of Environmentalist Presidents, global warming trends, deforestation from acid rain, and traces of benzene in Perrier, problems rapidly outpace solutions.

In the context of responsible use, conservation and management of water resources, legal concepts don't just happen. These concepts run the gamut from structural solutions, such as diversion of rivers and use of low water weirs, to management and conservation practices, such as tailwater return systems, erosion and sedimentation control, and nonpoint source pollution control, to federal and state environmental legislation and regulatory programs aimed at preventing or reducing water supply contamination.

This presentation will accordingly focus on emerging and changing legal concepts which form the underpinnings of the recently organized YMD Joint Water Management District and which are being created and shaped to serve the public interest.

I. Introduction

Surface water and groundwater are part of a single hydrologic system. In recognition of this fact, state legislatures, Congress and the Courts have become increasingly responsive during the past decade to growing concerns on the state and national level over such issues as groundwater overdraft, groundwater pollution, and ag-chemical runoff. On the state level, increasing emphasis is being placed on comprehensive structures for management, conservation, and long-range water resource planning.

Fragmentation in the area of water resource management has been a problem for quite a while and not just on the state and local government level. President Teddy Roosevelt wrote in 1913 that water issues had been dealt with as

> a disconnected series of pork-barrel problems whose only real interest was in their effect on the re-election or defeat of a Congressman here and there.[1]

Roosevelt's lament on the failure to win reform of national water resource policies was followed by many national commissions and studies by blue-ribbon committees which urged basic changes in our nation's water resource management system, both from a policy and an institutional standpoint.

Since 1802 the federal government has carried on programs to develop our nation's water resources. The federal water resource program has also been the subject of controversy. Given that there are over twenty-five different federal agencies that administer different water programs and given that there is a definite need for efficient management of our nation's finite water supply, our nation must face "the disarray of its institutional arrangements for water resource management."[2] In this regard, the State of Mississippi and the Mississippi Delta, utilizing water management concepts and models developed in our southeastern and western states, have realized that this is a time for action.

A. The Mississippi Delta

The water resources of our state are among the most important of its natural resources and are vitally important to the state economy. The Delta is an alluvial flood plain which is today longitudinally scored with a large number of arterial rivers and streams and geologically outlined by a line of loess bluffs on the eastern side and the Mississippi River on the western boundary, paralleled by the mainline levee system protecting the region from headwater flooding. The northern boundary of the Delta is at the bluffs near the Tennessee/Mississippi state line, and the most southern latitude is just north of Vicksburg.

The Delta region is endowed with an enormous groundwater system as well as a surface water system consisting of arterial and crevasse streams which serve as drainage canals for the entire watershed.

Geographically, the groundwater resources are confined to the Delta region. The rich fertile soil of the Mississippi Delta, gradually deposited over the centuries by the muddy Mississippi River, along with this region's warm climate and plentiful rainfall, have made the Mississippi Delta a national leader in the production of cotton, soybeans, rice, and catfish. The people of this region have contributed mightily to the economic wealth of this nation and have had a profound cultural and spiritual influence upon our national identity. The Delta is the birthplace of the blues. Delta authors such as William Faulkner and Eudora Welty, to name but a few of the region's most prominent writers, have eloquently chronicled the human spirit through the joy and suffering of the region's inhabitants.

The Delta is also a land of hardship and poverty, notwithstanding its natural assets.

As an area rich in natural resources, the Mississippi Delta realizes that its economic future is tied to its remarkable and enormous asset. This region may thus be the most reliable producer of food for the entire nation in the 21st century.

Long the mainstay of the Delta economy, agriculture has made an important contribution to the economic well being of the region and the nation. The economies of the Mississippi Delta counties depend in large measure upon a predictably adequate supply of water for municipal, agricultural, industrial, and commercial uses. These water resources require proper planning and management to insure that they are conserved and utilized in an effective and efficient manner.

B. Water Law Development in Mississippi

Prior to 1985, a hodgepodge of legal rules governed the use of surface water and groundwater in Mississippi. Different and often arbitrary doctrines had an outcome-determinative effect upon the allocation of water supplies, depending upon the often unscientific classification of water as surface water (including diffused surface waters, watercourses, floodwaters, lakes, ponds, sloughs and swamps) or groundwater (including artesian or nonartesian percolating groundwater, groundwater flowing in defined underground streams, and diffused groundwater). A major revision of state water law occurred when the Mississippi legislature enacted the Water Resources Law of 1985. At the same time, faced with a growing awareness of the potential for water shortages in certain areas of the state, the state legislature enacted laws to authorize creation of joint water management districts for such purposes as establishing predictably adequate water supplies, conserving diminishing water sources, and developing additional or alternative water resources.[3]

C. Integration and State Control

Under the 1985 law, surface water and groundwater as sources of water supply were integrated, thus acknowledging hydrologic relationships in these water supplies in regard to use, storage, allocation and management. An administrative permit system of water management was created, predicated on putting water resources to the maximum beneficial use and preventing waste or unreasonable use. All water was declared subject to state regulation as opposed to absolute private ownership and control. The State of Mississippi was given the clear mandate to manage, protect, and utilize water resources, including the study and formulation of plans to conserve and augment existing water resources, control water for storage, and prevent unreasonable use of water. The reasonable use rule dramatically altered the common law doctrine of riparian rights, thereby promoting more efficient allocation of water.

Many states, including Mississippi, have moved to integrate all sources of water over the past two decades. Dan Tarlock in his treatise Law of Water Rights has also cautioned that

> the rate of progress is uneven and the artificial classifications superimposed over the hydrologic cycle continue to influence the development of water law.[4]

Water consumers rarely differentiate between surface and groundwater. Human use of water is essentially indifferent to its source.

> Functionally, as opposed to both law and economics, humanity has not much cared whether large water drafts came from streams, runoff impoundments, or groundwater. Once human technology had moved from direct dependence upon rainfall to a demand for a steady supply from sources indirectly dependent upon rain, only reliability mattered. Whether a stream or an aquifer was the source was thereafter mostly a matter of technological indifference.
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> Hydrologically, a justification for this attitude does exist. Groundwater is connected to surface flows and cannot be regarded as

an isolated phenomenon. River and groundwater basins are rarely disconnected. Transfers between them occur naturally. True fossil water is rare, although it may be present even in recharging aquifers and even though aquifers may recharge so slowly that from a human viewpoint the result is the equivalent of mining fossil water.[5]

D. Local District Formation

On the heels of these substantive revisions of state water law, sixteen counties lying wholly or partly within the Mississippi Delta utilized a model structural arrangement for creating a local water management district. The legal issues facing the Yazoo-Mississippi Delta Joint Water Management District are complex. Old legal concepts of water law, including the different allocation rules applicable to surface water and groundwater, need to be revisited, revised and perhaps modified to serve the greater public interest and to assure beneficial and reasonable use of water resources. Immediate attention must be given to our fundamental understanding of how water is used by agriculture in the Delta.

Crop irrigation has become essential to agricultural economies of most states west of the Mississippi River. It is becoming a vital component of successful intensive agriculture in states east of the Mississippi, and for this reason severe drought is disastrous generally for most agricultural areas in the country, not just the western states. Drought coupled with antiquated and inadequate water storage and distribution systems can be equally catastrophic.[6]

Unfortunately, national attention has focused on the vital importance of water often only as a result of or during drought episodes, but these have long been treated as mere transitory crises, followed by a predictable return to increasing water use and consumption. Inadequate water supplies, serious supply-demand imbalances, unreplenished and declining groundwater supplies, and a growing number of water quantity/water quality problems aren't just on the horizon. In many of our country's water resource subregions, these problems are here and now.

Legal issues must be resolved with regard to:
(1) diverting water from the Mississippi River to enhance inland stream flow and to provide additional sources of irrigation, (2) a host of water quality and environmental considerations incident to artificial recharge of aquifers, (3) utilization of low water weirs and other structural alternatives to enhance the availability of surface water while avoiding conflict with existing drainage districts, (4) measures to reduce the likelihood of aquifer mining and to achieve a balance between withdrawal and recharge, as well as
(5) measures to eliminate or ameliorate potential contamination of groundwater and surface water supplies caused by saltwater intrusion, agricultural chemical runoff, and other sources of nonpoint source pollution.[8]

Mississippi's integration of all sources of water, its abandonment of artificial classifications once superimposed over the hydrologic cycle, and the creation of the Yazoo-Mississippi Delta Joint Water Management District as a local water management agency, are positive influences upon the development of a consistent and systematic body of water law and concepts. This is indeed a time for action, a time for developing and implementing specific objectives for the prudent management and stewardship of the water resources of our state and region, to the end that the quality of life and economic future of the people of this state and region will be enhanced and secured.

II. Background on Formation of YMD Joint Water Management District

A. 1979: Water Resources Committee of Delta Council

In 1979, the Water Resources Committee of Delta Council obtained the most accurate groundwater data base for the Mississippi Delta as compared to any other region in the state. Studies specifically addressed concerns regarding the stability of the Mississippi River Alluvial Aquifer in the face of increasing growth of irrigation and catfish production in this region. Through coordinated action of federal and state agencies, including the Bureau of Land and Water Resources and the U.S. Geological Survey, five hundred well sites throughout the Mississippi Delta were monitored.

B. 1983: U.S.G.S. Computer Model

The U. S. Geological Survey computer model on the Mississippi River Alluvial Aquifer was developed by 1983, and the hydrologic data and studies showed the clear need to develop a forecast on groundwater supply, the consequences of drawdown, and reliable projections based upon increased water use associated with the opening up of rice allotments and the upswing in the catfish industry. Time was of the essence.[10]

C. 1984: Mississippi Water Management Council

In the spring of 1984, Governor William Winter appointed the Mississippi Water Management Council, a 32-member organization directed to compile hydrology data on the remainder of the state similar to the data compiled for the Mississippi Delta region. The data compiled for the Mississippi Delta revealed that the region should be regarded as one geological water resource region. The Mississippi Water Management Council thoroughly considered several approaches to water resources planning and management and how water resources problems would ultimately be solved at the local level after such problems had been identified and carefully evaluated in light of whatever alternative remedies might be viable and available. The Council also received input from representatives from the states of Georgia, Arkansas, and Florida about water resources management activities and institutional arrangements.

1. Institutional Arrangements

Three philosophies of institutional arrangements were considered by the Council.

a. Super Agency

First, a "super agency" could be established for the purpose of doing all technical field studies, generating all management plans, and then actually building whatever might be needed to solve a particular problem. Such an agency could even be given authority to generate revenues by a variety of means to solve specific water resource problems in a given area of the state. This arrangement would eliminate the need for any sub-state entity of any kind.

b. Central State Agency

A second option, built around a central state agency such as the one in place in Florida, would establish all water resources policy through this single agency with implementation and actual field regulation through local districts which are created, empowered, and funded by the legislature. This option would offer considerable potential for eliminating local political perversion of water resources management programs.

c. Local Districts

As a third option, counties and municipalities would be allowed to organize themselves into local districts to deal with their own particular water resources problems under the general guidance of the appropriate state agency which at that time was the Mississippi Commission on Natural Resources. The Council decided upon this option, rather than recommending a system of river basin district agencies covering the entire state, based on the feeling that those who ultimately are going to receive the benefits from particular projects to solve particular water problems, and who will likely have to pay for these problems, should have a far more prominent role in planning activities than in the past. It was recognized that river basin plans have been generated across the state for many years and while many sound recommendations to solve certain problems have been made, most have not been implemented because the ultimate decisions were made not at the local level of government, but higher in the system, and generally by a particular federal or state agency.

The Mississippi Water Management Council thus made, and the state legislature accepted, a recommendation to give county and city governments a new vehicle to organize themselves into local districts, called joint water management districts.[11] Under House Bill No. 149, common interests of a region would be represented to a legally authorized water management district consisting of two or more governmental entities. Such a district would allow local input for water management planning and the implementation of policies compatible with local needs. As part of the same legislative package, Omnibus House Bill No. 762 defined state water policy, providing that a water management plan will be developed for the entire state.

2. Major Aquifers in Delta

The Delta's deep aquifers, the Sparta and Cockfield, yield a plentiful supply of high quality water for industrial processing and municipal uses throughout the Delta. These aquifers are primarily recharged from a region east and northeast of the Delta, according to geologists. The quality and reliability of these two formations have been important in the location of certain industries to the area and in providing an economical source of municipal and domestic drinking water supplies.

A third aquifer, the alluvial or shallow aquifer, is also an important geological water resource of the region and has been the focus of much attention in recent years. This aquifer is similar to the other two groundwater formations in the Delta, the Sparta and Cockfield aquifers, in the fact that it belies the entire region creating, as described by geologists, a single underground reservoir. This shallow aquifer has

characteristics that remain constant the entire length and width of the Yazoo-Mississippi Delta.

D. 1985-88: Local Efforts to Establish Water Management District

It has long been recognized that the characteristics of the surface water and groundwater formations in the Yazoo-Mississippi Delta are unique. It would be virtually impossible to provide any uniform and effective means to efficiently manage this resource with more than one water management district. Scientists and geologists have pointed out that a large percentage of the sources of surface water originate within the boundaries of this area, and the major groundwater aquifer formations remain constant throughout the length and width of the Delta region. Beginning in 1985, meetings were held throughout the counties comprising the Mississippi Delta and adjoining counties, in which elected officials, leaders from both the public and private sector, and the general public were actively involved. It became increasingly clear that uniform measures of management and conservation through a single water management district in the Delta represented the only viable alternative for the Delta region to address its water management needs. The only other alternative was to opt for a plan that will be provided perhaps years in the future by some appropriate state agency.

With the formation of a water management district in the Delta, this region would have the opportunity to continue to compile and maintain an accurate data base for the region and would be granted the option of developing and implementing proposals most compatible with the local interests of the Delta region. This ability to act locally would be preserved if a water management district could be formed encompassing the entire Yazoo-Mississippi Delta. Without such a local water management district, the Department of Environmental Quality, formerly the Mississippi Department of Natural Resources, as the state agency charged with enforcement of state water laws, would have to utilize existing hydrology data developed by the U. S. Geological Survey and the state to protect and maintain water resources of the region for the public good; further, data being surveyed by the U. S. Environmental Protection Agency, the State Department of Health, and the Bureau of Air and Water Pollution Control would be utilized to monitor and assess the need for action to maintain quality standards in groundwater and surface water.

The choice, in a nutshell, was between forming a local water management district able to control its own destiny or inviting state regulatory control.

E. Key Provisions of Charter

In a spirit of compromise which led to the development of a comprehensive charter for the Yazoo-Mississippi Delta Joint Water Management District, sixteen counties lying wholly or partly within the Delta region created the Yazoo-Mississippi Delta Joint Water Management District and appointed a Board of Commissioners which held its organizational meeting in July, 1989.

1. Purposes

The district was created for the purposes of promoting and maintaining water resources conservation, management and development; establishing and implementing water supply, water quality and water utilization plans and programs; sponsoring, acquiring or constructing devices or measures to insure predictably adequate water supplies for domestic, agricultural, commercial and industrial uses; participating in water resources planning and management programs of appropriate state, federal and local agencies; financing such measures; and other functions necessary to implement the policies of the district.

2. District Powers

The Board of Commissioners of the district have the power to adopt, modify, and enforce rules and regulations to carry out the purposes of the creation of the district, provided these are not in conflict with regulations promulgated by state regulatory agencies responsible for regulating the activities which the district was created to perform. The district is empowered to acquire, maintain, and operate facilities and to contract with other entities for services, water supply and water distribution systems; has the power of eminent domain for the purpose of acquiring land or other property for temporary or permanent easements or rights-of-way and for construction,maintenance or repair, improvement and extension of facilities or special water supply or pollution abatement projects; and the authority to adopt a plan for management of the water resources of the district, which must be submitted to and approved by the Department of Environmental Quality as consistent with the State Water Management Plan or objectives; and other general and enumerated powers.

3. Funding

The District's administrative operations are funded by a tax levy upon property of the member counties. These funds are used for the preparation and

implementation of the district's administrative operations and water resources management plan, exclusive of capital expenditures. The Board of Commissioners has authority to issue revenue bonds and to levy special assessments and establish user fees or charges necessary or appropriate to implement the measures identified in the water resources planning and management operations of the district.

4. Short Term Goals

Several of the short term goals of the district include choosing a location within the district as the central office, selection of a district management and staff, both administrative and technical. The central office of the district has been established at Delta State University in Cleveland, located in Bolivar County, Mississippi. Dr. Dean Pennington has been employed as Executive Director and staff positions are being filled.

5. Long Term Goals

Long term goals for the district include the development and implementation of a water management plan which will clearly prioritize the objectives and goals of the water management district, consistent with the authority delegated to the district by the state. These goals will be implemented through coordination with appropriate federal and state agencies and water resources organizations such as the Groundwater Management Districts Association, National Water Resources Association, and other organizations concerned with the management, development, conservation, and protection of water resources. For example, the District may consider water management plans or portions thereof as adopted by similar districts in the western and mid-western states, such as the water management plan for 1980-90 as set forth in the Texas Groundwater Conservation District Operations Manual, highlights of which are summarized as follows:

(1) Continue enforcement of rules and regulations of the district, including protection of the aquifer from pollution and prohibit waste.
(2) Inventory groundwater resources and public maps illustrating quantity and a real distribution of this resource.
(3) Promote on-farm conservation with on-farm irrigation efficiency testing.
(4) Develop public school education programs to promote better understanding of groundwater and the need for water conservation.
(5) Utilize existing water education information material and development of new educational tools for distribution to the general public.
(6) Conduct research and demonstration projects.
(7) Develop programs to assist local towns and cities in evaluating their current water supplies and, if needed, assisting them in locating additional supplies needed to satisfy long-term needs.
(8) Maintain a program to provide at a reasonable estimate of the net depletion of an aquifer via annual measurements of depth-to-water below the land surface in a network of observation wells.
(9) Determine baseline quality of water in the aquifer and subsequently determine if any changes in the quality of the water in the aquifer have occurred.
(10) Monitor soil chemistry to detect salinity and nitrate build-up.
(11) Promote water conservation by the urban population.
(12) Set in place any program or activity that provides an opportunity for improvement in water use efficiency or promotion of conservation.
(13) Promotion of cooperative efforts by all public agencies to promote water conservation with a minimum of duplication.
(14) Provide services to landowners, operators, and residents of the district.

G. Delegation of Authority

It is anticipated that once the Yazoo-Mississippi Delta Joint Water Management District has been sufficiently funded and staffed to undertake its mission expressed in the creating resolutions adopted by the sixteen member counties and in its charter, consisting of a district manager and staff competent to actually perform the necessary duties of the district, a viable water resources management plan for the district will be developed. When that plan is submitted to and approved by the Department of Environmental Quality, it will then serve as that component of the overall statewide water resources management plan for the Yazoo-Mississippi Delta.[12]

The role of local water management district in actual planning activities is reinforced by provisions of state law, by which the Department of Environmental Quality may actually "delegate to any joint water management district authority to assist the Commission in preparation, administration, and implementation of the state water management plan, or any activity related thereto, in such districts." Miss. Code Ann. Sec. 51-3-21(10) (Supp. 1985). Moreover,

the State Permit Board is allowed by statute to "delegate authority to any joint water management district to receive, investigate, and make recommendations to the Permit Board regarding applications for permits required under this chapter." Miss. Code Ann. Sec. 51-3-15(f) (Supp. 1985).

1. Factors Affecting Delegation

The decision by the state to delegate authority to the local water management district would be predicated upon the district showing that it is competent to perform the proposed activities sought to be delegated. The relationship between the local water management district and the state would be analogous to the relationship between the United States Environmental Protection Agency and the states to whom are delegated various programs which arise under federal law and which are administered at the state level.

2. Mechanics of Delegation

It is anticipated that the Yazoo-Mississippi Delta Joint Water Management District will submit a formal proposal for the Department of Environmental Quality to delegate authority to the district: (1) detailing the nature of the delegation sought, (2) fully explaining and justifying the capability of the district to perform as proposed, and (3) setting forth sufficient information to show that the district has adequate personnel, equipment and other resources to undertake the proposed delegated activities.

3. Periodic Reviews of Delegated Programs

If full or partial delegation were to be awarded to the district, periodic reviews of the delegated programs would be made, probably on a time frame similar to that experienced by the state with the federal government, either quarterly or semi-annually. The state, through its Department of Environmental Quality and the Permit Board, would retain concurrent jurisdiction and could intervene whenever either body determines that the actions of the local water management district are inconsistent with or in violation of the articles of delegation.

4. Preemption and Revocation

For example, if any enforcement powers were delegated and the local water management district ignored or refused to enforce those statutes or regulations covered by the delegation, then the state would likely intervene, preempt the abdicating district, and take such enforcement action as deemed appropriate. Revocation of the delegation of authority could also occur if program reviews by the state disclosed that the local water management district was simply not performing or not able to perform according to the articles of delegation.

In this manner, the state, acting through the Department of Environmental Quality, would be able to insure the state legislature that state law will be implemented and enforced by the local water management district in the same fashion as if the programs had remained exclusively within the Department of Environmental Quality or the Permit Board.

5. State vs. Local Government Enforcement

There are three primary differences between the local water management district and the state with regard to enforcement of water law.

First, the citizens of the Delta region will have the ability to voice their opinions for present and future use of the Delta region's water resources, whereas there would be no local input if only the state regulated and enforced the law.

Second, the local water management district will continually monitor all water use, both groundwater and surface water, and will have the most up-to-date data on which to base decisions, whereas the Department of Environmental Quality is not equipped to do in-depth monitoring or carry out local planning and management functions.

Third, the local water management district will develop alternative sources of water and conservation, responsive to local needs, capabilities, and circumstances, whereas the Department of Environmental Quality is not equipped to provide this service.[13]

6. Federal vs. State/Local Government Management

Over twelve years ago the Council of State Governments made similar observations in addressing the role of state and federal governments in water management.[14] This struggle involves more complex issues than state as opposed to federal jurisdiction and goes far beyond the question of federal intrusion in areas of traditional state domain. It is a part of the tug-of-war between environmental groups and advocates who favor giving states more power and discretion over federal water management resources. Increased sensitivity to environmental quality, the

need for substantial mitigation of fish and wildlife damages associated with water projects, and a growing body of environmental legislation have reinforced congressional power over water resources policy in this nation.[15]

The Council identified areas for improvement in state water resource planning, allocation, and management:

a) Inattention at the executive level to major policy issues raised by water problems, due to relegating water management to the realm of water professionals;
b) Insufficient consideration of the relationship of water resource management to long-term state economic growth and vitality, community development, settlement patterns, and environmental quality;
c) The need for innovation, sensitivity to local conditions and responsiveness to local preferences represented in the states as opposed to the alternative of centralized government solutions offered by Congress and federal agencies;
d) The need for states to strengthen their own water resource organizations and water management capacity.[16]

Intrastate Water Management.

In 1973, the National Water Commission published Water Policies for the Future which contained a detailed analysis of the problems and shortfalls of intrastate water planning and management.[17] The Commission noted that many intrastate water planning and management organizations in various parts of the United States represented local, pragmatic, proactive approaches to water management needs and were created to serve specific local purposes, often not encompassing a full range of water interests. The authority granted to many of these organizations may not allow them to deal with such important water concerns as groundwater management, fish and wildlife propagation, recreation, and water quality. The organizations often do not deal with problems as logical wholes and have no established mechanisms to integrate their planning with federal, state, and local agencies.

Broadened Scope Needed

The Commission specifically recommended that the scope of functions for intrastate water management organizations be broadened to allow them to forge more comprehensive management plans. It was recommended that states give these management agencies better guidance on how their local planning and development programs affect and are affected by one another and by federal and state agencies with related water interests.

Local Management Agencies

The Commission promoted upgrading and strengthening such local management agencies to enable them to become effective, independent, and economical. The Commission also noted that local water planning and management organizations may fail to plan for management of water resources in which there is a federal interest, thus adversely affecting the federal water planning interest. Volume, quality, and dependability of supply in the main stems of large rivers, the Commission noted, are affected by the resource use and development policies in upstream watersheds under state or local control. Federal water interests can thus be advanced through encouraging and assisting local and state governments to do a better job of building effective intrastate basin planning organizations in their areas and achieving better local water management.

The National Governors Association in February 1978 endorsed a Position on National Water Policy which set forth these basic principles upon which national water policy should rest:

1. States have primary responsibility for water management.
2. The proper federal role is to establish a framework of national objectives and to assist states in the development of programs to meet those objectives.
3. Water management should be more comprehensively approached at all government levels.
4. Federal actions must be consistent with state and interstate water plans and programs.
5. There must be continuity in federal support for water management programs.
6. Greater flexibility in the federal support system for water management is needed.
7. Criteria for federal water program and project evaluation should be refined and uniformly applied.
8. Financing, cost-sharing, and cost recovery policies should be revised to eliminate inequities toward water problem solutions and to promote equal consideration of structural and nonstructural alternatives.
9. Water conservation must be a fundamental consideration.

10. Federally supported water research should be expanded and made more responsive to state concerns.
11. Indian and federal reserve water rights claims should be initially addressed within the framework of state legal systems.[18]

These same concepts were echoed in December, 1989, by National Water Resources Association Executive Vice President Tom Donnelly, who emphasized that the NWRA supports **state and local primacy** in the groundwater area, with a **limited federal role** in technical and financial assistance. Donnelly called for a sharing of technical expertise and information between those states which are farther behind in groundwater protection, management, and conservation efforts.

In his keynote address to the National Water Resources Association's 58th Annual Conference in San Antonio on November 1, 1989, Manuel Lujan, Jr., Secretary of the Department of Interior, also emphasized that one of the principles which will guide the Department of Interior during the Bush administration is that states have the **primary responsibility** in the area of water rights. The Secretary of the Interior also emphasized the present **stewardship role** of the Department of Interior in developing natural resources and protecting the environment. At that same conference, John Sayre, Assistant Secretary of Interior for Water and Science, pointed out that the Department of Interior will utilize the Water Policy Council to coordinate various interests, including those in areas of water quality and quantity, and that the federal role will not be to get involved in the state and local role of allocation of water resources.

These goals, recommendations, and principles were clearly advanced by Mississippi's Omnibus House Bill No. 762 and Water Management House Bill No. 149 under which the Yazoo-Mississippi Delta Joint Water Management District was created.

III. Profile of Delta Water Resources

A. Mississippi River Alluvial Aquifer Model

Most of the water pumped in the Mississippi Delta is used for crop irrigation and catfish farming and comes from the Mississippi River Alluvial Aquifer. In recent years, the catfish farming industry has become a major user of groundwater, second only to irrigation of rice, cotton, and soybeans. Overall use of water from the alluvial aquifer increased from about 200 million gallons per day (mgd) in the early 1970's to about 1.1 billion gallons per day (bgd) in the early 1980's. This increasing use of water from the alluvium and decreasing water levels in the early 1980's prompted a study by the U. S. Geological Survey, which in 1984 published its Water-Resources Investigation Report 84-4343, entitled "Summary of Results of an Investigation to Define the Geohydrology and Simulate the Effects of Large Groundwater Withdrawals on the Mississippi River Alluvial Aquifer in Northwestern Mississippi." This report was prepared in cooperation with the Mississippi Department of Natural Resources and the Bureau of Land and Water Resources.

1. Purpose of U.S.G.S. Study

The purpose of the study was to better understand and define the hydrology of the Mississippi River Alluvial Aquifer in northwestern Mississippi and to quantify the effects of future withdrawals of water for irrigation, catfish farming, and other uses. The principal report from this investigation of the Mississippi River Alluvial Aquifer in the Delta described the geohydrology of the alluvial aquifer as determined by field investigations, data analysis, and by development and testing of a digital model of the alluvial aquifer.

2. Geohydrology of Delta

With respect to the geohydrology of the Delta area, the 7,000 square mile Mississippi River Alluvial Plain in northwestern Mississippi, known commonly as the Delta, is underlain by a prolific aquifer that as of 1983 yielded about 1.1 billion gallons per day (bgd) of water to irrigation wells. Commonly about 20 feet of clay underlying the Delta land surface is underlain by about 80 to 180 feet of sand and gravel. Water level profiles developed during the U.S.G.S. study proved that the Mississippi River was in good hydraulic contact with the alluvial aquifer. The profiles developed by the U.S.G.S. study generally showed that the smaller and less deeply incised the stream, the less likely it is to have a good hydraulic connection with the aquifer. Water level profiles, potentiometric surface maps, and well hydrographs generally showed that direct vertical recharge to the alluvial aquifer from precipitation was small, especially in the central part of the Delta.

3. U.S.G.S. Model

A finite-difference digital model was selected to simulate groundwater flow in the alluvial aquifer. This model showed that the aquifer had a net loss in storage of about 400,000 acre feet per year (360 mgd) for the two year period from April, 1981, to April,

1983. During this period pumpage was about 1,270,000 acre feet per year (1.1 bgd). The net inflows from the sources of recharge were as follows:

Source	Acre-Ft.-Year	MGD
Mississippi River	440,000	390
Areal Recharge	200,000	180
Recharge Area along East Edge of Delta	190,000	170
Yazoo-Tallahatchie-Coldwater River System	51,000	45
Oxbow Lakes	27,000	24
Sunflower River	12,000	11
Bogue Phalia	1,100	1

4. Simulation of Groundwater Withdrawals

With regard to simulated effects of groundwater withdrawals, the calibrated and verified model of the alluvial aquifer was used to estimate aquifer responses in the future. Various pumping stresses were simulated for a twenty year period beginning September, 1983, including a pumpage of 1.1 bgd and 1.9 bgd. The drawdown that would occur during these twenty year projections is demonstrated on a series of maps. Not only did the alluvial aquifer model disclose variables in both thickness and drawdown, it also demonstrated that the drawdown area is at its greatest where it is farthest from the Mississippi River. These areas of the greatest drawdown coincide with the areas where catfish farming and rice farming are most prolific. It is clear that with increased pumping rates the drawdown depths and areas increase.

B. Future Problems

As the saturated thickness of the alluvial aquifer diminishes over the projected twenty years of continuous pumpage at these specified rates, the water levels decline, the saturated thickness of the aquifer becomes less, the average yield of the wells will be smaller and water supply problems will occur. Groundwater mining would ultimately occur, the long term effects of which include a lowering of groundwater levels making pumping more expensive, groundwater quality degradation, land subsidence, and possibly saltwater intrusion.[19]

IV. Physical and Structural Characteristics

A. Water Use Studies

The total amount of water and its equilibrium in the hydrologic cycle have been the subject of much scientific investigation and not-so-scientific speculation for well over a century.

Valid quantitative data is not plentiful, however, and many aspects or components of the complete hydrologic cycle are not yet known beyond approximations of values or estimates.

1. 1988 Water Use Survey

Dr. Dean Pennington, while working as Associate Crop Physiologist with the Delta Branch Experiment Station in Stoneville, Mississippi, spearheaded a water use survey during 1988 to determine water use relative to catfish farming and irrigation of rice, cotton, and soybeans. As part of a program to get the best estimate of water use possible with the very limited resources and time available, questionnaires were developed and mailed to a randomly selected group of rice, cotton, and soybean farmers, who were asked to report information relating to the ways they used water on different crops on their farms. While additional research remains to be done to determine the smallest quantity of water needed, as a minimum requirement, to allow optimum productivity in growing the various crops, several tentative conclusions can be drawn concerning water use in the Mississippi Delta. In his new position as Executive Director of the YMD Joint Water Management District, Dr. Pennington has recommended a continuation and expansion of such water usestudies and surveys.

2. Agricultural Usage

Agricultural usage accounts for approximately eighty (80%) percent of all of the water used in the Delta, allocated among the principal crops as follows:

Rice	70 percent
Catfish	15 percent
Soybeans	8 percent
Cotton	8 percent

The remaining twenty (20%) percent is divided about equally between urban and industrial users.

3. Rice Production

Rice production is a tremendous water user. Rice acreages have really fluctuated, depending upon the going surplus and the current prices. Water for rice production can be either groundwater or surface sources. These are the rice acreages in the Delta from 1977 to 1988:

Year	Acreage
1977	110,000
1980	250,000
1981	340,000 (graded acreage to date)
1982	245,000
1983	160,000
1984	192,000
1985	181,000
1986	194,000
1987	193,000
1988	270,000

At an average eighty inches of water per acre, the total water used in the Delta in rice production comes to about 1.7 million acre feet per year or 1.6 billion gallons per day, a very large part of the water available to agriculture in the Delta.

4. Catfish Farming

Another very big water user is aquaculture, or catfish farming, which generally uses only groundwater as the source of water supply. This is due mainly to the purity requirements of raising catfish. Surface waters are considered too contaminated with pesticides, fertilizers, and the like as well as being a carrier of various bacteria harmful to catfish. Catfish farming accounts greatly for the economic well-being of the state as a whole as well as the Delta area. Catfish ponds are really water management structures in which it is easy to see changes in water levels and when and how much water needs to be added to maintain adequate water levels.[20]

Catfish production in 1987 accounted for almost thirty-eight (38%) percent of the water used in the Mississippi Delta, and there is almost five times the acreage committed to catfish production in 1988 as compared to only eleven years ago in 1977:

Year	Acreage
1977	18,000
1980	40,000
1984	63,000
1985	76,000
1986	82,000
1988	88,000

5. Cotton and Soybeans

Even though the number of acres involved in irrigation of cotton and soybeans is large, the opportunities for water conservation and management are not as great as compared to rice and catfish farming, since there is a smaller overall quantity of water used in irrigating cotton and soybeans. In rice and catfish farming there exists almost no penalty for excessive water use other than the fuel bill, but in cotton and soybean farming, if the farmer uses too much water he begins to depress yields. In cotton and soybean farming, moreover, the opportunities for excess pumping of water are relatively small. Because of the design limitations of sprinkler irrigation systems used on cotton and soybeans, it is difficult to use excessive amounts of water.

B. Political and Financial Considerations

Agriculture is a multi-billion-dollar industry in the State of Mississippi with a tremendous rollover effect. The value of farm production in the state of Mississippi in 1988 was approximately $3.5 billion, forty-five (45%) percent of which was attributable to the Mississippi Delta.

Not only did the total value of agricultural production in the state reach this all-time high of $3.5 billion in 1988, that year was also the second consecutive fairly good income year. Agriculture and agribusiness will remain the basis for much of the economic activity in the Delta, and jobs in the agribusiness sector and in the manufacturing sector as well appear to be increasing, which should help stabilize the economy in a year when farm income declines. As jobs in the agribusiness and manufacturing sectors increase, these will complement the highly efficient agricultural sector and cause the future of the Delta to be bright.

1. Lower Mississippi Delta Development Commission

The status and interrelationship between such areas as natural resources, human resources, infrastructure and transportation, business and commerce, and government will determine the Delta's capacity to build the type of strong regional economy necessary for it to become a full partner in America's future.

The Delta is in a state of change. Agriculture, long the mainstay of the Delta's economy, will continue to play an important role in the Delta's economy, while efforts to diversify this sector and the economy in general will result in a greater emphasis on processing and manufacturing activities, which will in turn impact on the environment and compound current environmental challenges.

a. Lower Mississippi Delta Development Commission's Ten-Year Plan

The Lower Mississippi Delta Development Commission [LMDDC] was established through the initiative of a bipartisan coalition of senators and representatives from the Lower Mississippi Delta region. The LMDDC will develop by 1990 a ten year plan making recommendations and establishing priorities to alleviate identified needs. In this regard, the LMDDC is mandated to develop an inventory of water and other natural resources in the region and to evaluate the proper roles of state, local, and federal governments, and the private sector in fostering economic development in the Delta region. In carrying out its mandate under Public Law 100-460, the LMDDC has requested state-of-the-art papers from the U. S. Soil Conservation Service, the U. S. Army Corps of Engineers, and other collaborating entities to provide the LMDDC with an assessment of current trends as they pertain to a variety of topics. The information obtained from the LMDDC's inventory and state-of-the-art papers will provide the foundation upon which coordinated strategies for unlocking the Delta region's abundant potential can be built.

b. Federal Cost-Sharing

Senator Dale Bumpers (D.Ark.), who proposed the LMDDC's creation, has noted that Congress is likely to be asked to rewrite the regulations used to channel federal money back home. To qualify for help under current rules, local governments typically must match a percentage of the federal share, a requirement that the poorest and neediest counties simply cannot meet. According to Bumpers, the federal government also could redirect its spending so that the Delta region could reap greater benefits. Further, as pointed out by Arkansas Governor Bill Clinton, who chairs the bipartisan commission, government research funds could be allocated on a geographic basis.

c. District Participation in LMDDC-Suggested Projects

Since the LMDDC's Interim Report noted that groundwater contamination and depletion threaten to undermine agricultural productivity, which is one of the areas where the Delta region excels, it is possible that if federal funding were made available to the Yazoo-Mississippi Delta Joint Water Management District on a less stringent cost-share basis to implement one or more of several water resource projects which have been presented to the Water Management District, this would appear to be a feasible and attractive avenue for attacking several of the problem areas noted in the Lower Mississippi Delta Development Commission's Report. It would also appear to be a more attractive alternative to the federal "rescue projects" to import water. As noted in the National Water Commission's 1973 Report, the federal interest in groundwater depletion stems from the likelihood that threatened regions will seek extravagantly expensive rescue projects.[21]

2. Opportunities for District

Numerous opportunities exist for the YMD Joint Water Management District to take the lead in water resource management, planning, research, and education.

a. Water Quality and Contamination

For example, water quantity cannot be examined in isolation from water quality. Water contamination can result from soil erosion, agricultural chemicals, and pesticides washed from fields, salts washed from soil during irrigation, channel contamination from discharge of organic or inorganic compounds from municipal water supply systems or industry, and other sources which ultimately reach rivers and groundwater.

Contamination of existing and potential water supply sources seriously threatens public health and the environment. At least nine federal programs deal in some manner with groundwater quality. A host of federal and state environmental statutes deal with water supply contamination generally, including:

1) Clean Water Act, 33 U.S.C. Secs. 1251-1376 (1982), as amended [CWA];[22]
2) Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. Secs. 9601-9657 (1982), as amended [CERCLA];[23]
3) Safe Drinking Water Act, 42 U.S.C. Secs. 330F-330J-10 (1982), as amended [SDWA], under which exists the Underground Injection Control Program, 42 U.S.C. Sec. 300h(b)(1), which prevents contamination of groundwater [UIC];
4) Resource Conservation and Recovery Act, 42 U.S.C. Secs. 6901-6991 (1982), as amended [RECRA];[24]
5) Federal Insecticide, Fungicide and Rodenticide Act, 7 U.S.C. Sec. 136-13 (1982), as amended, which is apparently being intended to curb the risk of pesticides entering water supplies.

although its full potential in addressing groundwater contamination has not been developed;[25]

6) Mississippi Underground Storage Tank Act of 1988, Miss. Code Ann. Secs. 49-17-401 to 49-7-433 (Supp. 1988);
7) Toxic Substances Control Act, 15 U.S.C. Secs. 2601-2629 (1982), as amended [TSCA];[26]
8) Surface Mining Control and Reclamation Act, 30 U.S.C. Secs. 1201-1328 (1982);
9) Uranium Mill Tailings Radiation Control Act, 42 U.S.C. Secs. 2014-2114, 2201, 7901-7942 (1982);
10) National Environmental Policy Act, 42 U.S.C. Secs. 4321-4370 (1982)[NEPA].[27]

b. Surface Water Monitoring

Surface water monitoring may be undertaken. We have had two of the driest summers of record and during 1988, the record drought had little effect on most of the aquifers in the state but had a considerable effect on the alluvial aquifer. It was initially believed by some state officials that the highest water levels experienced in July, 1989, were due to runoff, or tailwater, which is generally lost and ends up in the Gulf of Mexico, but massive flooding during that period may have and probably did cause a general rise in groundwater levels throughout the Delta counties. The Department of Environmental Quality has noted that the lowering of the water levels in the aquifer affects base flows in the streams and has proposed that by the year 1992 only four inches of tailwater will be allowed to leave a field. This amount is subject to review and change based upon additional information and research data becoming available. This is not unlike many of the western states, notably Nebraska, where no tailwater is allowed to leave a given field or area.[28]

It appears that the District would have a golden opportunity to lead in educating and promoting volunteer implementation of tailwater recovery practices, utilization of straight levees for rice production, voluntary use of flow meters and other management and conservation practices and potential solutions to water supply problems.

c. Research and Technical Assistance

Research has shown that only thirty inches of water per acre are needed to grow rice, but we are using up to eighty inches per acre each year. The Water Management District could initiate an accelerated research program and implement technical assistance to farmers, including educational research on straight vs. contour levees. In the context of catfish farming, a $300 million per year industry in the Delta, cultural practices such as paddle-wheel aeration, in lieu of simply turning on the pump, could be addressed. Other measures may be studied and undertaken to address the fact that in catfish farming there will be an inevitable evaporation of approximately twenty-five (25) inches of water each year using the pond level of approximately four feet.

State and Local Primacy

On a broader scale, Tom Donnelly, Executive Vice President of the National Water Resources Association, in his keynote address given at the Groundwater Management Districts Association Technical Seminar, "A Time for Action," on December 6, 1989, in Oklahoma City, emphasized that the NWRA recognizes the need to effectuate a sharing of technical expertise and information between those states which are doing the best job in groundwater management and those states which are farther behind in groundwater protection, management, and conservation. In this regard, proposed legislation has been introduced in Congress to establish a management agency within the Environmental Protection Agency, with provisions for cost sharing between local government entities and the U. S. Geological Survey, with funding for groundwater studies on the state and local level according to Donnelly.

Federal-State Relationship

At the core of the federal-state-local relationship in the area of water resources planning and management is the issue of state primacy. At one end of the spectrum are the proponents of federal-state partnerships and cooperation in water resources planning, with states assisted by local management agencies serving as the focal point for water resource management. At the other end of the spectrum are advocates for federal water resource development who sometimes can justifiably point to the absence of adequate state and local management of water resources.[29]

In an area as complex as it is vital to our national economic development, most will agree on at least one thing: water resource management is rapidly becoming a critical factor in determining patterns of population growth and settlement in this nation and has a substantial impact on both economic development and environmental quality. As such it can and does profoundly change land uses and economic activities in many communities and regions.[30]

d. Chemical Treatment and Disease Control

Other opportunities for research, management, and planning in catfish farming could include chemical treatment and disease control and prevention through means other than turning on water pumps, which studies would necessarily include food safety aspects and aeration considerations.

e. Optimum Water Use Studies

Studies could also be continued on cotton and soybean irrigation to determine optimum water use, preliminary indications being that only eight (8) inches of supplemental water may be needed, depending on rainfall patterns, planting dates, soil types, localized rainfall patterns, efficacy of irrigation systems, slope of the land, and other factors.

On a broader scale, much is to be gained through the sharing of technical knowledge and the development of innovative management and conservation plans and techniques in water management districts throughout the country, particularly in the western states. Dr. Mike Kizer, Director of Oklahoma State University Extension Service, has promoted and advocated the efficient use of irrigation water, utilizing a model which incorporates:

1) irrigation scheduling, which revolves around how much and when to apply water, aimed at achieving water resource conservation, profitability, and alleviation of environmental concern;

2) scheduling methods, which include calendar, visible plant stress, soil fill and appearance, sophisticated equipment such as electrical resistance blocks, pensiometers and neutron probes, and soil water budget (checkbook scheduling) methods; and

3) crop water use, which should be evaluated in terms of crop growth stage, soil water supply and weather conditions, including temperature, solar radiation, humidity and wind.

With this model, the decision to irrigate would be made when the total solid water deficit equals the management-allowed deficit.[31]

f. Nonpoint Source Pollution Control

Measures can be implemented to counteract pollution and contamination of our natural waters, all of which are a unit and are in a state of active exchange. Such measures may include water quality initiatives such as erosion and drainage control measures through coordination with the Soil Conservation Service, studies with the Sedimentation Laboratory at the University of Mississippi, and control of nonpoint sources of pollution.

In an article entitled "Nonpoint Source Pollution: An Overview of Primary Sources, Effects and Controls" (Water Resources Seminar, February 3, 1990), George T. Malvaney addressed nonpoint source pollution, a complex problem affecting U. S. water quality. While not specifically covering the effect upon groundwater by nonpoint source pollution, Malvaney did address surface water pollution from nonpoint sources.

Best Management Practices

One of these methods for reducing or controlling nonpoint source pollution is Best Management Practices, which are site-specific prevention methods, that is, designed for flexible implementation at individual sources of nonpoint source pollution. Malvaney noted that in order to implement Best Management Practices on lands and activities deemed sources of nonpoint source pollution, a program of regulatory and nonregulatory options would have to be instituted.

> Federal, state, and local agencies, working together, have developed such a plan. Essential components include the following: volunteerism, which involves making those concerned aware of the effects of NPS pollution and encouraging corrective measures; education, a form of volunteerism, which requires convincing the public that controlling NPS pollutants is in their best self-interest; technical and financial assistance, which requires making current technological methods of NPS control available and providing at least partial funding where needed; command and control policies, which involve mandating specific actions of NPS pollution control; economic incentives, which involve raising the monetary costs of generating NPS pollution; and cross-compliance methods, which require certain conditions of NPS control to be met in order to be eligible for certain federal programs.[32]

Malvaney concluded that the future of nonpoint source pollution depends upon public awareness, implementing effective controls which prevent or reduce soil erosion, and integration of planning and implementation of nonpoint source pollution control by government agencies at all levels.[33]

g. Pesticide Container Program

A pesticide container national pilot program is now being carried out by the Mississippi Bureau of Pollution Control, the Environmental Protection Agency, the Cooperative Extension Service, and county government with funding from the National Agricultural Chemical Association. This program could be expanded with district

participation. Boards of Supervisors in several central Delta counties are being encouraged to participate in the program which addresses disposal of plastic and metal pesticide containers. Utilizing collection sites throughout the counties, farmers could rinse and dispose of containers, which would in turn be baled in 500 lb. bales and processed into plastic pellets. This pesticide container disposal program addresses the problem of illegal dumping and burning of containers.

h. Mississippi River Diversion

The U. S. Army Corps of Engineers, Vicksburg District, has completed the reconnaissance phase of a Water Balance Study, the overall goal of which is to determine the feasibility of using the Yazoo-Mississippi Delta's surface water resources to supplement the needs of agricultural irrigation in the region.

Feasibilty Phase

The remaining phases of "feasibility" and the development of alternative proposals remain to be completed in order for the citizens of the Delta region to determine whether utilization of surface water is a viable alternative for agricultural irrigation. The Corps has been seeking a sponsor to assist in the completion of the feasibility phase of the Water Balance Study which was initiated in response to a 1973 Senate Resolution sponsored by Senator John C. Stennis. Current and future water use trends were evaluated during Phase I of the study and documented in the Water Demands Study Report. Groundwater and surface water supplies were evaluated in Phase II of the study and compared to the results of the demands report. Groundwater supplies were assumed to meet needs such as aquaculture, livestock, municipal and industrial, fish and wildlife, and thermoelectric power uses. Surface water supplies were broken down by drainage area and applied to crop irrigation demands. Areas with insufficient surface water to meet crop irrigation demands were identified for potential water supply alternatives. The result of the Phase II studies were documented in the Water Balance Report.

Conceptual Alternatives

Conceptual alternatives which have been developed to meet the remaining crop irrigation demands include pumping stations on the Mississippi River to supplement interior streams. Diversion sites were evaluated to determine if feasible surface water alternatives exist.

The Corps study reveals that the total surface flow deficit of approximately 12,000 cubic feet per second was found for the entire Yazoo River Basin, and the areas of greatest concern were found in the west central part of the Delta. Small stream flows in this area cannot keep up with massive irrigation demand experienced now and predicted to occur in future years. For this reason, this area was a primary target for alternative measures designed to reduce aquifer stress in the alluvium.

Multipurpose Alternatives

These alternatives are multipurpose in concept. It must be emphasized, furthermore, that tentative measures such as proposed interbasin transfers as a means to provide supplemental surface water into interior streams will not only be for irrigation purposes, but will have a positive influence upon wildlife habitats as well as water quality in terms of maintaining adequate stream flows above minimum required levels.

In this regard, pumping stations on the Mississippi River and diversions from major inland streams would provide the necessary water to meet these needs. Weirs could be placed in streams identified for improvement to enhance surface pumpage, improve water quality and fisheries, and maintain groundwater levels. Greenbelts along major streams could reduce sedimentation from sheet erosion, provide cover and habitat improvement for various wildlife species, and also reduce channel maintenance needs. Grade control structures could be placed at the confluence of tributaries with major streams to reduce erosion and pond water for irrigation as well as for water fowl during the winter months.

Multiple Benefits

Thus, in the face of dwindling groundwater supplies, supplemental surface water would be a means of maintaining crop production levels, allowing the Mississippi River Alluvial Aquifer to replenish itself through natural recharge, and enhance the environment for wildlife. Such measures could not only improve environmental conditions through sediment control but could also provide water during drought conditions and thereby improve water quality and fishery resources in area streams, for example, through various control structures which would provide water management capability for fishery and water fowl resources.[34]

Cost-Sharing

With the passage of the Water Resources Development Act of 1986, Public Law 99-662, new changes to the planning process occurred, most significant of which was a two-phase planning process referred to above, the reconnaissance phase, and the feasibility phase. While the reconnaissance phase is entirely federally funded, the feasibility phase is cost-shared fifty-fifty by federal and non-federal interests. The reconnaissance phase has as its goal to identify a feasible project with a federal interest and to identify a non-federal interest to share the cost of feasibility studies and eventual construction.

Mechanics of the Feasibility Study

The feasibility study assembles data that help to determine economic, environmental, and engineering solutions to the problem and their associated impacts on the environment. During the preparation of the study, public meetings are held to determine the wishes of local interests. The desires of local interests are fundamental not only because of the effects of construction on the local area, but also because under specific conditions, the law requires them to participate in certain features of the project. During the preparation of the study, other federal and non-federal agencies concerned with any phase of the resources planning or development are contacted to avoid conflict with their program or to incorporate features of their program into Corps' projects. When all the data are analyzed and determination is made of the fullest possible use of the natural resources, the study with its recommendation is submitted to Congress. If approved, the recommended projects become authorized for construction by an act of Congress. After authorization, the projects still require congressional appropriations before preconstruction engineering and design can begin. After a project has been authorized for construction and subsequently receives congressional appropriations, the project enters the preconstruction engineering and design stage. During this stage, detailed design is accomplished and the plans and specifications are prepared for construction of the project. After preconstruction engineering and design is completed, the project is eligible for consideration as a construction start along with other worthy water resources projects throughout the nation. After Congress makes funds available for construction, the Corps of Engineers prepares to award the first construction contract and supervise construction. The completed projects may be operated and maintained by the Corps or they may be transferred to another agency or to local interests to operate and maintain.[35]

Western States' Experience

The seventeen mid-western states have been tackling the thorny issues of allocation of water resources, priority of use, and allocation for well over twenty-five years in a very intense regulatory context. Regulation of use, water shortages, and water resource management issues in Mississippi will probably be more understandable if we try to benefit from the experience of the seventeen mid-western states.

Federal Role

In the context of diversion of the Mississippi River to augment surface water supplies and relieve stress upon the groundwater system, we may be about to enter an area of federal water management or at least federal coordination of state and local management of water resources.

Interstate Water Transfer Projects

It should be noted that other interstate water transfer schemes have been proposed as means of augmenting water supplies, including diversion of water from the Mississippi River to West Texas, diversion from the Columbia River to the Colorado Basin and California, and diversion from Canadian rivers to the western United States. It should also be noted that in the event of severe drought conditions in the proposed source areas as occurred in the Columbia River diversion proposal, state and local interests can be the source of vigorous resistance.

Rivers and Harbors Act

Consideration should also be given to the Rivers and Harbors Appropriation Act of 1899. If a water intake structure for purposes of diversion of Mississippi River water into inland streams were to be installed in the river channel such that it created a potential hazard to navigation, a Section 10 permit under the Rivers and Harbors Appropriation Act would have to be applied for.[36] Such a permit must be obtained from the Army Corps of Engineers prior to building the structure. Under the Corps of Engineers' regulations, a permit is required even if the structure is built outside the navigable portion of the channel if the structure affects the course, location, or condition of the water course in such a manner as to impact on the navigable capacity of the waterway.[37] In Sierra Club v. Morton,[38] the Court applied this provision to the taking of water from a river to a pumping plant for distribution to other areas of the state, when the diversion lowered the water levels and decreased water velocity downstream from the intake facility, thereby resulting in obstruction to navigable capacity of the river. Pumping plants constructed by the state were held to constitute a sufficient obstruction to navigable capacity so as to require approval under 33 U.S.C. Sec. 403. Export pumping by these pumping plant facilities both lowered water levels and at times caused net flow reversals in the waterways.

Section 10 Permit

Application for a Section 10 permit would have to be made to the District Engineer in charge of the district where the proposed activity is to be performed. The application must generally include:

1) A complete description of the proposed activity;

2) The location, purpose, and intended use of the proposed activity;

3) Scheduling of the activity;

4) Names and addresses of adjoining property owners;

5) Location and dimension of adjacent structures; and,

6) The approvals required by other federal, interstate, state or local agencies for the work, including all approvals received or denials already made. Further, the applicant is required to furnish additional information as requested by the District Engineer.[39]

Interstate Commerce Considerations

In 1982, the United States Supreme Court fundamentally altered the authority of states over groundwater resources within their boundaries. In Sporhase v. Nebraska ex rel Douglas,[40] the Court held that groundwater rights were commodities in interstate commerce. Although noting Congress' deference to state water law, the Court stated:

> Groundwater overdraft is a national problem and Congress has the power to deal with it on that scale.... [T]he existence of unexercised federal regulatory power does not foreclose state regulation of its water resources, of the uses of water within the state, or indeed, of interstate commerce in water.[41]

The essential holding of Sporhase was that water is an article of commerce that must be available to residents of the various states on essentially the same terms as it is available to residents of the state of origin.[42]

I Augmentation of Water Supplies.

Aside from interstate water transfer and diversion schemes, proposals for augmenting water supplies have taken a variety of forms, including:

1) conservation measures which entailed water saving devices as well as careful control and timing of water applications;

2) reclamation and reuse of water;

3) land treatment processes, for example, to reclaim and recycle municipal wastewater;

4) groundwater storage as a physical solution to overdraft of aquifers, salt water intrusion, and subsidence;

5) aquifer recharge by means of spreading basins and injection wells;

6) large scale desalination in the form of tapping seawater for freshwater supplies,

7) cloud-seeding and other forms of weather modification,

8) modification of vegetation cover,

9) snow melt control, and

10) towing icebergs from the Arctic for use as drinking water during major shortages.[43]

J. Wetlands Protection and Management

The consequences of drainage of wetlands include, on the positive side, the expansion of land available for agriculture, timber, and building construction. On the negative side, drainage of wetlands has an adverse affect on fish and wildlife, migratory water fowl habitat, and recreational opportunities, and has also been linked to fluctuations in streamflows and lower groundwater levels.[44]

Wetlands jurisdiction now extends to isolated inland areas unconnected with any body of water. Groundwater saturation can now be a sufficient basis for wetlands jurisdiction, even in the absence of surface water inundation.[45] Wetlands law can be applied and considered much as a national zoning law, and it has grown tremendously over the past two decades, now constituting a significant segment of environmental law.[46]

Among the purposes served by wetlands, one of the principal ones is maintaining groundwater supplies.

> Wetlands retain rainwater, which in turn often percolates into aquifers, providing critical groundwater supplies.[47]

Wetlands regulation as a legal issue first reached the United States Supreme Court in a 1985 case involving water criterion for wetlands jurisdiction, United States v. Riverside Bayview Homes, Inc., 474 U.S. 121 (1985). In this case, the Court held that there was a sufficient basis for wetlands jurisdiction for a source of water to be groundwater. Wetlands jurisdiction was not limited to areas flooded by surface waters. In so holding, the Court in Riverside broadly interpreted the Corps of Engineers' definition of wetlands that included areas saturated by groundwater in addition to areas inundated by surface waters.[48] Following this reasoning, a federal district court in 1986 ruled that it was not essential for wetlands jurisdiction for groundwater to reach the surface if the soils were sufficiently saturated to meet the Corps of Engineers' definition of wetlands.[49]

The Environmental Protection Agency has the ultimate authority for wetlands jurisdictional determinations, an authority "birthed in the middle of one of the most controversial wetlands cases to date."

Avoyelles Sportsmen's League, Inc. v. Marsh.[50] The Fifth Circuit's decision was based in part on an opinion by then U. S. Attorney General Benjamin Civiletti. The Civiletti opinion ultimately led to an interagency Memorandum of Understanding on "geographical jurisdiction of the Section 404 program."[51] On January 19, 1989, these agencies entered into a revised Memorandum of Agreement which made it clear that the Corps of Engineers will routinely make wetlands determinations and will "continue to perform the majority of the geographic jurisdictional determinations."[52]

V. Proposed Projects, Studies, and Activities

A. First Year of Operation

Charles Branch, Director of the Bureau of Land and Water Resources of the Mississippi Department of Environmental Quality, has suggested that the following could be performed by the Yazoo-Mississippi Delta Joint Water Management District during its first year of operation:

1. Fund an evaluation of the chemical and physical properties of Delta surface water by Mississippi State University to form a data base that may later be used in the aquifer recharge study.

2. Set up the district staff, both managerial and technical, during this crucial year.

3. If technical staff is on board, assist the Bureau of Land and Water Resources with the April, 1990, water level measurements of selected wells to determine rise/decline of static water levels of the alluvial aquifer.

4. Assist the Delta Branch Experiment Station and the USDA Soil Conservation Service with the evaluation of water use and conservation practices in rice production for the 1990 cropping season.

5. Evaluate the possibility of additional low water weirs located at various sites on selected small streams in the Delta.

These recommendations are being actively considered by the District.

B. Water Use Study

The District has the opportunity to assist in the second year of a water use study conducted under the direction of Dr. Dean Pennington, Executive Director of the YMD Water Management District, to determine the smallest quantity of water needed, as a minimum requirement, to allow optimum productivity in growing the various crops. Use of controlled laboratory conditions to evaluate, graph, and measure minimum water use and application would be involved in this effort. These studies would include employment of field personnel to take fulltime water measurements throughout the Delta and to verify the survey-type data with actual field measurements.

Equipment

Field equipment could be used to measure the minimum water requirement of rice, for example. Soil field containers would be placed into the soil of a rice field, one container having a closed bottom and an open top with rice planted in this container. The water level in the container would be held constant by a float mechanism, and the amount of water required to maintain a constant water level would be recorded. The water that must be added to the container to keep the water level constant is equal to the water lost from the container. Water can be lost from the first open top, closed bottom container only by evaporation and transpiration. A second container has an open bottom and a covered top, and no rice is planted in this container and water is lost from this container only by percolation. By carefully recording the water used in these containers over the flood season, the water used by the crop can be measured. This minimum amount of water required can then be compared to the amounts presently being used by growers. This will indicate the potential for water conservation in rice production. The comparison will be useful to water resource planners to indicate the potential for region-wide resource conservation and to rice growers to indicate their potential for reduction in water pumping costs.

Satellite Data

Another area where resource use can be inventoried is the use and application of satellite data.

Economic Value of Water

Quantification of the economic value of water in the Delta,in terms of increased productivity, can be evaluated on a more specific and informative basis than is provided by acre/feet data alone.

Technology Transfer

It has been pointed out that the Israeli technology transferred to the west, particularly Arizona, is more applicable to arid climates and is not very comparable to

Mississippi, so we will be blazing some new trails in this part of the country in the continuation and completion of this water use study. For example, many of the groundwater aquifers in the west are not rechargeable or renewable, whereas the Mississippi River Alluvial Aquifer has a large amount of recharge annually in certain amounts, thus indicating that we are faced with the problem of balancing recharge with withdrawals to allow a predictably adequate supply of water for an indefinite period of time, as opposed to just prolonging the ultimate mining of aquifers.

VI. Legal Issues on the Horizon

As our society's water consumption increases and the quality of natural water deteriorates, we are compelled to devise legitimate means to restore the quantity and improve the quality of natural water. Entities such as the YMD Joint Water Management District are in a position to undertake a program of systematic education coupled with qualitative and quantitative conservation, management, and long-range planning.

The authority of states over groundwater resources within their boundaries, the development of federal groundwater policy, coordination of groundwater pollution laws, regional water allocation and planning, applicability of the public trust doctrine to interstate water issues, and a growing national focus on groundwater overdraft are but a few of the complex legal issues and developing legal concepts which we see on the horizon. Without management, conservation, and planning, accelerated changes in water quality resulting from a plethora of human activity indeed can threaten the entire hydrographic system and the existence of our society.[53]

The water problems are staggering and their solution will be no less than monumental.

VII. Conclusion

The hydrologic cycle has neither a beginning nor an end, but consists of many complicated processes – precipitation, transpiration, evaporation, retention, percolation, runoff, and others. The cycle controls the distribution of available water for human use and consumption. Water law and the task of water managers are a function of the incomplete fit between the availability of water in its various forms and the demand for various usages of that precious resource. This is, indeed, a time for action, a time for shaping water law and management concepts to serve the public need.

> "And you shall be like a watered garden, like a spring of water, whose waters fail not."
> Isaiah 58:11

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