TEXAS WATER DEVELOPMENT BOARD

# Water for Texas

## Today and Tomorrow
## —1992—

# TEXAS WATER DEVELOPMENT BOARD



The People of the State of Texas

November 19, 1992

We are pleased to provide you with the recommendations for the 1992 update of the Texas Water Plan, last amended by the Texas Water Development Board (Board) in December 1990. The updating process has been an on-going effort which has considered input from an Outside Advisory Panel representing governmental, engineering, environmental, and other professions; various water-interest groups; community leaders; and the general public. The Board wishes to acknowledge and thank those persons and organizations who have contributed their time and expertise to this important endeavor.

The 1992 Texas Water Plan update reflects Board efforts to consider amendments to the Plan every two years and is formatted as an amendment to the more detailed 1990 Plan. In addition to updating significant water projects and related planning data, the 1992 Water Plan update emphasizes future priority Board actions and key policy recommendations to local, State, and Federal entities and the Texas Legislature in the areas of:

- ★ financing of water infrastructure and environmental protection
- ★ economically distressed areas programs
- ★ regional ground-water management
- ★ innovative water allocation techniques
- ★ floodplain management
- ★ conservation and reuse
- ★ drought and emergency water supply management
- ★ environmental water needs
- ★ planning coordination
- ★ basic data collection and information dissemination

Local governments' future ability to implement and finance new water-related facilities will be significantly stretched to keep pace with population growth as well as environmental, health, and public safety concerns. Action is needed now to insure that Texas government is responsive to the water needs of all of its citizens as our great State enters the 21st century.

Sincerely,

Craig D. Pedersen
Executive Administrator

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# WATER FOR TEXAS
# TODAY AND TOMORROW

## RECOMMENDATIONS FOR THE 1992 UPDATE OF THE TEXAS WATER PLAN



Sections 16.051 and 16.055 of the Texas Water Code direct the Executive Administrator of the Texas Water Development Board to prepare and maintain a comprehensive State Water Plan as a flexible guide for the orderly development and management of the State's water resources in order that sufficient water will be available at a reasonable cost to further the economic development of the entire State. In addition, the Board is directed to amend and modify the State Water Plan in response to experience and changed conditions.



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# RECOMMENDATIONS FOR THE 1992 UPDATE OF THE TEXAS WATER PLAN

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# Executive Summary

## Background

In the 1990 Texas Water Plan, Water for Texas, Today and Tomorrow, the Board recommended reviewing the Plan biannually to consider amendments needed because of changed conditions. The Legislature subsequently amended the Texas Water Code to reflect this guidance.

This report, Recommendations for the 1992 Update of the Texas Water Plan, has been prepared in response. The report includes the Board's review of changed conditions, the significance of these changes relative to the 1990 Plan, and preliminary staff recommendations as to whether the Plan should be amended. Input from many diverse sources, including staff analyses, an Outside Advisory Panel, water interest groups, and the public, has been considered in the final version of the recommendations adopted by the Board in November 1992.

## Updating Philosophy

Because Board review of the 1990 Census data produced no substantial divergence from the 1989 forecasts presented in the 1990 Texas Water Plan and because few dramatic changes were noted in most water projects described in 1990, the majority of this update is devoted to water policy recommendations to be considered by the Legislature or other arms of government.

**It should be stressed that any project recommendation made in the 1990 Plan remains in effect unless subsequently amended with the adoption of the 1992 Update.** Simply because a previously-recommended project is not discussed in this update does not remove it as a Plan recommendation, but indicates instead that no substantial changes have occurred related to the project since December 1990. In instances where the 1990 Plan policy recommendations have been fully implemented, the 1992 Update will not repeat the achieved recommendations. All 1990 Plan policy recommendations shown as partially implemented, or not implemented, remain in effect.

This Executive Summary features key water policy, regional, and project-related Plan recommendations. The following detailed document refers to water management topics and projects discussed in the 1990 Plan, outlines accomplishments and actions since 1990, details relevant 1990 Water Plan issues and new issues, and lists recommendations for amendments to the 1990 Texas Water Plan.

# 1992 Update to the Texas Water Plan
## Key Policy Recommendations

| Policy Issue | Update Recommendations |
|---|---|
| Financing Water and Environmental Resources Management | The Legislature should consider:<br>★ a continuing source of appropriations ear-marked for State investment in water-related infrastructure and environmental protection to:<br>• help Texas communities to meet the heavy financial burdens caused by Federal/State regulations;<br>• assist communities with limited financial capabilities;<br>• promote appropriate regional facilities and management,<br>• offset the loss of federal funding; and<br>• finance water conservation/reuse innovations, water quality improvements, and environmental protection.<br>★ supporting repeal of Federal tax law precluding effective financial assistance for certain types of conservation programs currently defined as private benefit. |
| Economically Distressed Areas | The Legislature should consider:<br>★ the level of available State, Federal, and private funding sources to provide for the water and wastewater disposal needs of economically distressed areas, where currently-identified needs are more than two-times currently authorized State financial assistance.<br>★ providing adequate funding to the Texas Attorney General for enforcement of "model" subdivision rules.<br>The Board and the Attorney General should:<br>★ continue to identify and monitor any weakness in State land development law so that appropriate action can be taken to prevent recurrence of these utility and public health problems.<br>The Board and the Legislature should:<br>★ monitor the required state loan/grant ratio to ascertain effects on project feasibility for severely distressed areas. |

| Policy Issue | Update Recommendations |
|---|---|
| Regional Ground-water Management | The Legislature should consider:<br>★ providing the Texas Water Commission with appropriate authority, consistent with that given districts in Chapter 52 of the Water Code, to work with local entities to establish necessary management measures in areas where the State has been unable to establish a district to effectively address existing or potential ground-water problems.<br>★ allowing the Board to loan funds for this interim program until local district financing can be established.<br>★ examining and enacting methods for streamlining and improving the Critical Area process.<br>The Board should:<br>★ provide expanded assistance to ground-water districts to improve data collection and to enhance the development of long-range ground-water management plans. |
| Innovative Water Allocation Techniques | The Governor, Lt. Governor, and Speaker of the House should:<br>★ appoint an Advisory Committee to review the existing State water allocation system for its ability to efficiently meet future water needs, maintain and improve water quality, and protect environmental resources. Consideration should be given to existing State law and precedent, agency rule-making, and other states' experiences with approaches to allocation procedures.<br>The Board and Texas Water Commission should:<br>★ analyze and develop recommendations for alternative State and regional institutions, such as water banks, that could facilitate water rights or water sales transactions. |
| Drought and Emergency Management Planning | The Governor, Lt. Governor, and Speaker of the House should:<br>★ appoint an Advisory Committee to develop a State contingency plan to provide for appropriate regional or statewide responses to reduced water supplies during drought, contamination, or other emergency conditions. Potential responses to global climate change should also be considered as a part of this contingency planning. |

| Policy Issue | Update Recommendations |
|---|---|
| Conservation and Reuse | The Texas Water Commission should:<br>★ continue its efforts to incorporate water conservation initiatives into its water-related regulatory programs. To encourage conservation with a minimum of regulatory administration, consideration should be given to the incorporation of measures-based approaches as key elements of required conservation plans.<br>★ provide for adequate funding, monitoring and enforcement of the Water-efficient Plumbing Act provisions passed in the 72nd Legislative session.<br>The Legislature should consider:<br>★ providing the TWC and the Board with sufficient funding to fully investigate and better define the potential for water reuse and its potential effects upon downstream water rights, water supply, and water quality. |
| Environmental Water Needs | The Board, Texas Parks and Wildlife Department, and Texas Water Commission should:<br>★ cooperate to expeditiously apply new State methodologies to each principal bay and estuary to determine freshwater inflow needs.<br>★ develop and apply appropriate methodologies to determine instream flow needs with priority given to those river segments that potentially will be affected by future water resources development projects identified in the Water Plan. |
| Flood Management Programs | The Legislature should consider:<br>★ providing funding for the monitoring, delineation, and prediction of flood events; for better public education and improved flood warning systems; and to develop an overall integrated and comprehensive statewide flood hazard mitigation program. These State efforts should be fully coordinated with Federal programs.<br>★ reviewing State law to encourage better enforcement of floodplain development restrictions and to promote full disclosure of known flooding risks in real estate transactions. |

| Policy Issue | Update Recommendations |
|---|---|
| Planning Coordination and Cooperation | The Board, Texas Water Commission, Texas Parks and Wildlife Department, in consultation with State leaders, other appropriate agencies and commissions, and the public should:<br><br>★ continue and expand current efforts to cooperatively assess and plan for key water issues facing Texas, in particular the development, production, and coordination of the 1994 Water Plan. Under the Board's statutory leadership, key coordination elements that should be immediately addressed by the agencies to provide for significant cooperative planning goals to be achieved by 1994 include:<br><br>• necessary scheduling requirements,<br>• agency resource commitments,<br>• agency mandates and roles,<br>• decision-making criteria and processes, and<br>• screening of planning and policy framework issues.<br><br>★ support these mutually-derived planning findings and recommendations, where feasible, before regulatory proceedings.<br><br>★ continue coordinating their public assistance programs to assure orderly and efficient service provision and to avoid any duplication between the agencies' differing regulatory, planning and technical assistance functions. |
| Data Collection, Research, and Information Dissemination | The Legislature should consider:<br><br>★ providing increased funding for basic water data collection and assessment, given the noticeable inadequacy of current data collection networks and continuing withdrawal of federal data collection support.<br><br>★ providing funding for the Board and State universities to allow basic and applied research in water resources investigations to continue. This basic information is critical to good planning, design, and regulatory decision-making. The Board's Water Assistance Fund, which has been the State's primary vehicle to fund basic water research, will be depleted at the end of FY1993.<br><br>★ providing increased funding for the Texas Natural Resources Information System to allow for better coordination of data collection, information standards, and more cost-efficient provision of information through electronic transfers and centralized provision of data. |

# 1992 Update to the Texas Water Plan
## Area/Project Recommendations

| Area/Project | Update Recommendations |
|---|---|
| Coastal Bend Region | Revise the Plan to advance the need for the Lake Texana/Corpus Christi conveyance system to 1996 due to reduced supplies from the Lakes Corpus Christi/Choke Canyon system as a result of a combination of reduced reservoir yield and required freshwater releases to Nueces Bay. The remaining 41,000 acre-feet (ac-ft) of available supplies in Lake Texana have been optioned by the Corpus Christi Port Authority for future use in the Coastal Bend Region. Additional surface water, which could further increase Lake Texana supplies, may be available from other nearby sources. Future regional water supply needs beyond 2040 should be examined as a part of the Trans-Texas study efforts. |
| Critical (Ground Water) Area #2 | Revise the Plan to recommend conjunctive use of surface and ground water in this area by extending supplies from Austin or the LCRA to communities in west Travis and Hays counties, use of some Lake Medina supplies for Bandera County, and study of potential surface water supplies for other Hill Country towns using Trinity Aquifer supplies. Innovative on-site approaches, such as "rainwater harvesting" systems, should be considered in some individual cases. Any large project development should receive appropriate environmental assessment. |
| Economically Distressed Areas | Revise the Plan to recommend the extension of municipal service or development of stand-alone utilities, where feasible, to provide water and wastewater utility service to approximately 1,200 identified colonias communities. |
| El Paso Region | The City anticipates that its reuse-recharge project could annually recharge up to 10,000 ac-ft to the Bolson Aquifer and anticipates other reuse possibilities providing about 35,000 ac-ft/yr. The City projects water conservation savings of about 50,000 ac-ft/yr by 2040. The 1992 Plan should also note: the El Paso's optioning of 24,000 acres of land for additional ground-water development that could provide for 15 years of water supply needs; the City working with area water districts to promote the conversion of unused irrigation rights to municipal uses; the further examination of alternatives for expanded use of upstream surface water supplies; and expanded dialog between regional water users through a Council of Governments task force and a Memorandum of Understanding with New Mexico. |

| Area/Project | Update Recommendations |
|---|---|
| Southern Edwards Aquifer | From the 1990 Plan recommendation to limit Edwards pumping to 425,000 ac-ft/yr, revise the Plan to increase water conservation savings to 100,000 ac-ft/yr of municipal/manufacturing use and to 60,000 ac-ft/yr of irrigation use by 2010. Also increase reuse to 40,000 ac-ft/yr by 2010. Revise potential Lake Medina supplies to 29,000 ac-ft/yr given new study information. Again, note potential permit problems with the potential Cuero Reservoir because of possible endangered species determination. Also revise potential Lindenau Reservoir supplies to 107,000 ac-ft/yr given new diversion modeling and a design option mitigating habitat inundation. In addition to previous recommendations from the 1990 Plan, investigate other potential water supplies, such as aquifer recharge, springflow augmentation, other local reservoir site options and major interbasin transfers.<br><br>Should a decision be made to provide for adequate springflows at preliminarily-determined biological need levels to protect endangered species at Comal and San Marcos Springs, this could be accomplished through managed pumping of the aquifer at an average limit of 165,000 ac-ft/yr, assuming no significant contribution from enhanced recharge or springflow augmentation during drought conditions. In addition to the demand management and development of new supplies specified above with more constrained pumping, further efforts would be needed to make up for substantially-reduced supplies. The Lindenau project's supplies could be increased from 107,000 to 207,000 ac-ft/yr through downriver recapture of maintained springflows. Goliad supplies would need to be increased through greater use of return flows as well as advancing its need to 2010. Even with these measures, an additional 60,000 to 100,000 ac-ft/yr of water supply deficiency would have to be addressed through drought management or other supply sources. |
| Bosque Reservoir/<br>Lake Waco | Revise the Plan to reflect that the projects have State permits and that federal Section 404 environmental permitting is underway. |
| Cooper Reservoir | Revise the Plan to show that the Cooper Reservoir constructed and conveyance facilities to the Dallas metroplex as scheduled for completion by 1994. |
| Eastex Reservoir | Revise the Plan to show Eastex and associated conveyance needed by 2000 should the project prove feasible for participation by an interested power company and sufficient local entities. Should near-term participation by the power company not materialize, project need could be delayed until 2010. |

| Area/Project | Update Recommendations |
|---|---|
| Goliad Reservoir | Revise the Plan to note that if springflows are guaranteed at Comal and San Marcos springs, Goliad supplies would need to be increased through additional use of return flows. The timing of need for the project would also be advanced to the year 2010. |
| Ivie Reservoir Conveyance Systems | Revise the Plan to note the conveyances from Ivie Reservoir to: San Angelo under construction with completion by mid-1993, Midland/Odessa under construction with completion by 1995, and Abilene scheduled for 2015 or beyond. |
| Lindenau Reservoir | Revise the Plan to show Lindenau supplies at 107,000 ac-ft/yr due to new modeling for a revised pool elevation to avoid inundation of valuable environmental habitat. If springflows are guaranteed at Comal and San Marcos Springs, recovery of this water at Lindenau could increase its supplies by 100,000 ac-ft/yr. |
| Medina Reservoir | Revise the Plan to show Medina supplies at 29,000 ac-ft/yr as a result of a new yield study by the U.S. Bureau of Reclamation. |
| Palo Duro Reservoir | Revise the Plan to indicate that construction of the project is complete and that the reservoir is currently filling. |
| Paluxy Reservoir | Revise the Plan to indicate that State court has remanded the State permit back to the Texas Water Commission for re-hearing. |
| Tehuacana Reservoir/ Trinity River Diversion | Revise the Plan to show the need for Tehuacana by 2040 due to initial study findings on the potential diversion of return flows from the Trinity River into the Richland Chambers/Cedar Creek reservoirs delaying the need for Tehuacana. |
| Texana Reservoir/Corpus Christi Conveyance System | Revise the Plan to indicate the preliminary determination of freshwater releases from Texana to the bay, subject to TWC approval, and to note the optioning of 41,000 ac-ft of remaining supplies to the Port of Corpus Christi Authority. Advance the need for conveyance facilities to the Corpus Christi area to 1996. Lake Texana could also be used as an interim storage facility for additional surface water supplies from other nearby sources. |
| Trinity River Chloride Project | Revise the Plan to indicate that a salt water barrier is under construction by the Corps of Engineers on the lower Trinity River. |

# RECOMMENDATIONS FOR THE 1992 UPDATE OF THE TEXAS WATER PLAN

## *1.0 INTRODUCTION*

Beginning in 1989, the Texas Water Development Board (TWDB) began a commitment to more frequently update the Texas Water Plan to keep it current and relevant to ever-changing conditions in the state and nation. This continuing Board effort for more frequent updates was first accomplished in the 1990 Plan, Water for Texas, Today and Tomorrow. Subsequent to the adoption of the 1990 Water Plan, the 72nd Texas Legislature passed Senate Bill 449 which amends Section 16.056 (a) of the Texas Water Code to provide that,

> "The board shall review the plan biennially to consider any amendment or modification that may be needed because of changed conditions."

As described below, this report documents the TWDB staff review and analyses of changed conditions, the significance of those changes relative to the Plan adopted in December 1990, and recommendations to the Board on whether or not the official State Water Plan should be amended and to what extent. This review and analysis process is reflected in this, the final version of the recommendations adopted by the Board, and represents the incorporation of input from many sources, including: TWDB staff studies; the input of an Outside Advisory Panel comprised of representatives of legislative, business, environmental, and other water-related interest groups; meetings with various water-related organizations; a policy opinion survey; a series of public meetings for citizen input; and written and verbal communications conveyed to TWDB regarding the update process and issues to be addressed.

## *1.1 BOARD STRATEGY FOR UPDATE CONSIDERATIONS*

To fulfill the requirements of the law and meet the informational needs of the public within available Board resources, a strategy for regular Water Plan amendment considerations was developed that proposes a major revision of the Water Plan every four years, and in the intervening two-year period, a recommendation to the Board of a less comprehensive amendment to the Plan prior to the next major revision. In developing the strategy on how to best accomplish this update process, a variety of factors were weighed so as to maximize the use and effectiveness of the Water Plan, given the available TWDB resources.

### *1.1.1 Impact of the Water Plan on the Public*

Given the Texas Water Plan's legal stature as a guidance document, rather than a regulatory document, it is important that, for the Plan to be effective, it have as much public "impact" as possible. Issuing frequent and redundant Plans, which would make it difficult for the readers to

tell what has changed, would not result in maximum public impact. Many of those who are involved in the Water Plan process would not have the time or sustained energy to spend months every two years participating in the planning process and could likely become "desensitized." This sentiment was voiced repeatedly in the last public meetings process when a two-year plan was discussed.

Another key element in assessing the effectiveness of the Plan is the ability of the TWDB and other agencies to effect its implementation. This would include staff working on specialty information and projects to further the Plan's acceptance and execution (including legislative summaries of the Plan by political district; drafting and providing technical resource support for legislation; study charges and support to interim committees; specialty studies furthering Plan recommendations; etc.); and as discussed below, the various efforts involved in Plan development and coordination.

### *1.1.2 Type of Process to Meet Public Needs Given Available TWDB Resources*

In the opinion of many who commented on the 1990 Water Plan, the type of Plan that would best meet existing needs is a two-part document consisting of a main technical planning document that has useful basic data, background material, and explanatory detail, sufficient for people active in the water industry to use in their day-to-day planning and management, as well as an Executive Summary that highlights the main issues for general public use and Legislative decision-making.

As reflected in Section 1.1.4, even the research, production, and coordination activities involved in a two-year update of the Water Plan still comprise a major effort that consumes a considerable amount of staff, management, and Board time and resources. Even a small document generally has many of the attendant research and coordination requirements associated with a large document - just fewer words, tables, and graphics. The Board does not currently have adequate staff or financial resources to produce such a major informational document on a regular two-year basis; further, given the constrained timeframe for a two-year major update of the Plan, a large two-part strategic document cannot be hastily produced in a repeated and continuous manner without problems in both quality and public coordination. A major update every four to six years with minor updates in the intervening two-year periods would result in higher quality documents and a more meaningful planning process.

### *1.1.3 Aspects of Changed Conditions and Levels of Significance*

Every day brings change. In some cases, the change may be significant such as a decrease in the availability of water resources. In most cases, however, it is more likely that the effects are minimal or are observed gradually. An important consideration of whether or not to amend the Water Plan and what the update provisions should be is how significant the changes are and whether they affect the content and relevance of the previous Plan. As discussed below, the evaluation of these issues are innately tied to the significance and use of the Water Plan itself.

***Availability and Quality of the Planning Data.*** Much of the data used in the Board's water planning efforts is widely used by planning entities and decision-makers throughout the State. The TWDB is the only State agency that regularly incorporates a 50-year, long-term forecast of the State's growth picture and its effects on water resources. The Board considers this long-term planning to be essential, given the lengthy process involved in the planning, decision-making, design, permitting, financing, and construction of large-scale water projects. The conceptualization, evaluation, and public/political education process involved in policy and program development to avoid or minimize future water-related and environmental problems necessarily involves a longer-term perspective.

Given the importance and widespread use of the Board's planning data, it is crucial that valid data be used in its formulation. Therefore, a key issue in assessing the extent and impact of changed conditions on the Water Plan is the quality of the data used to measure them. In order to satisfactorily update various aspects of the Board's forecasts and recommendations in the Plan, decisions must be made as to when bona fide data is available for these purposes.

***Impact of the Water Plan on Project Action.*** As previously mentioned, the Water Plan is, by law, a guidance document and does not have direct regulatory authority. Its recommendations are, however, to be used as a consideration in water-related permit proceedings. Since projects that are needed in the very distant future (30 to 50 years) are not typically before regulatory bodies for permitting or even being subject to planning or development decision-making by potential local sponsors at this time, the impact of the longer-term Plan forecasts are not especially significant except to provide some guidance in directing future planning. The real importance of Water Plan project recommendations relate to those projects needed within the next 30 years where more precise estimates are necessary to determine facility capacity needs, timing, costs, and potential environmental impact as they relate to project engineering, economic, and regulatory feasibility.

Therefore, recent minor changes which would likely have effects manifested only in the very long-term forecasts were generally not considered by staff to be significant enough to warrant a current amendment to the Plan. However, any recent changes which would have noticeable effects on major projects or actions needed in the near- or mid-term would certainly be considered significant enough to warrant specific consideration in the Water Plan update.

***Impact of the Water Plan on Policy Action.*** Another test of significance in considering a Plan amendment is as it relates to policy issues and subsequent activity. The recent actions of Federal, State, or local governments could affect the relevance or nature of previous policy recommendations, as might noticeably-changed physical or socioeconomic conditions. Conversely, government inaction and the worsening of a major problem area in need of expeditious policy action could also constitute a significantly-changed condition that warrants a restatement of previous policy recommendations.

***Summary.*** The Water Plan, to maintain its effectiveness, must reflect both significantly changed conditions and the need to maintain consistency and stability in its planning process.

There are many short-term anomalies in long-term development trends. To allow frequent short-term volatility to inappropriately affect long-term planning direction would rapidly undermine the usefulness and credibility of these data. While the details of short-term phenomena will be monitored by the Board for potential near and longer term effects on the State's water resources, every temporary change is not, in and of itself, a substantial basis for Plan update consideration.

## 1.2 ANTICIPATED TWO-YEAR UPDATE ACTIVITIES AND SCHEDULING

Exhibit 1, shown on the following page, indicates the scheduling of prior and prospective major activities in 1992 involved in the consideration of the Water Plan update in order that a final product would be ready for presentation to the 73rd Legislature by the end of 1992. As shown, the activities involved both in-house study and outside coordination efforts to develop a draft update document for public distribution and comment by the end of August 1992. A series of public meetings were conducted in mid-September after the distribution of the draft. A public hearing was held in October with final Board consideration for amending the Plan occurring in November, prior to the holiday period and the start of the 73rd Texas Legislature's First Called Session.

## 1.3 ORGANIZATION OF THE WATER PLAN UPDATE CONSIDERATION

The following three sections of this report relate the major topics of the update assessment process and the TWDB staff recommendations for amendment of the Water Plan. The discussion is organized and summarized by various major water-related topic areas as follows:

- ***Planning Bases***

  Have the underlying demographic, socioeconomic, engineering, legal, or regulatory conditions changed sufficiently such that an amendment to the Plan is warranted, and can these changed conditions be adequately identified to result in revised quality forecasts?

- ***Area/Project Assessments***

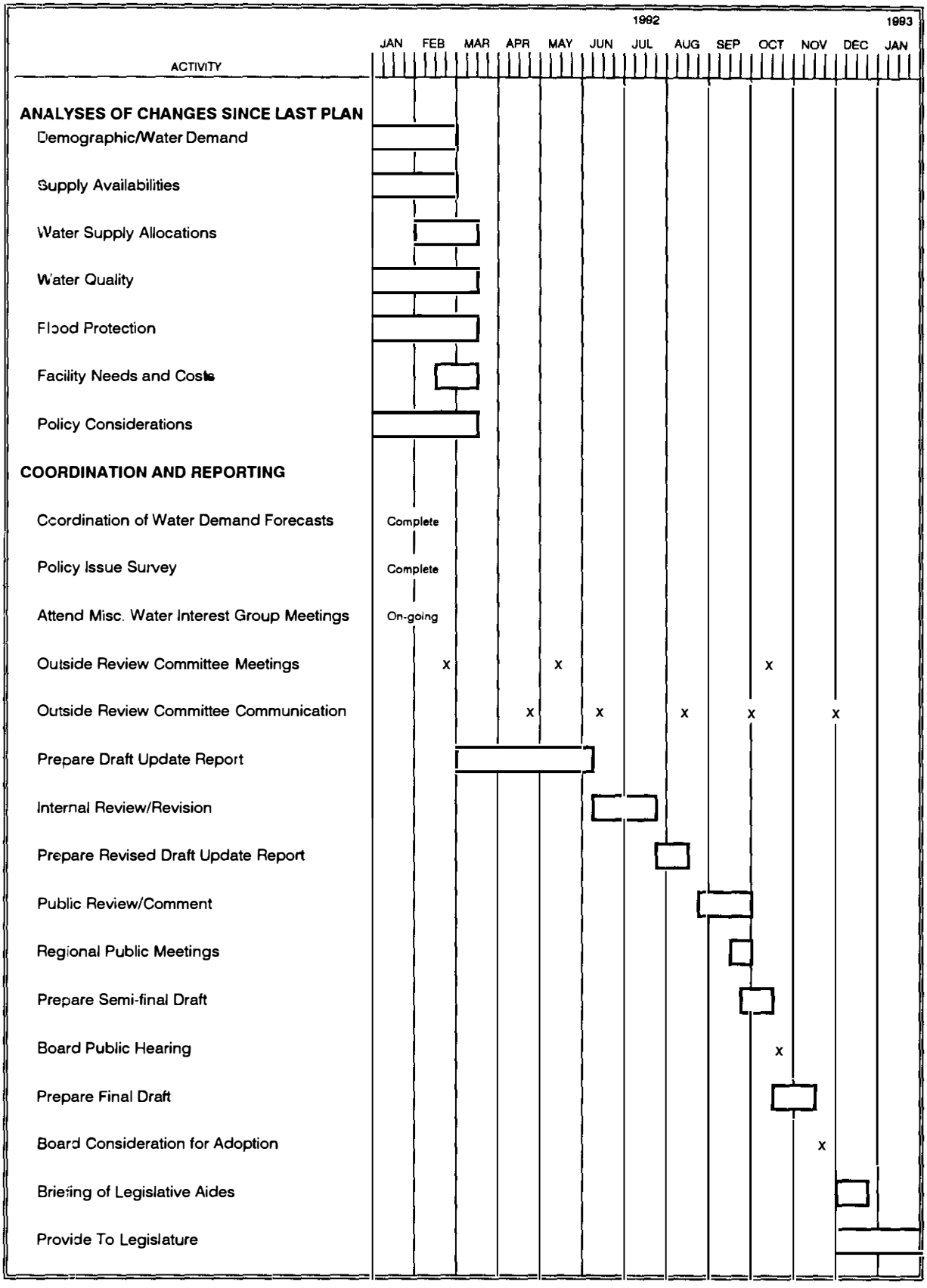
  How have those changed conditions, which can be adequately defined, resulted in revised water demand, supply, or facility needs recommendations for selected geographic areas of the State?

- ***Policy Concerns***

  Given existing water-related problems that have not been sufficiently addressed or changed conditions that have identified new concerns, what policy actions are required to meet these needs?

**EXHIBIT 1-1**

**SCHEDULING OF ACTIVITIES OF THE 1992 TEXAS WATER PLAN UPDATE**



## 2.0 PLANNING BASIS

### 2.1 REGIONAL BOUNDARY DELINEATIONS

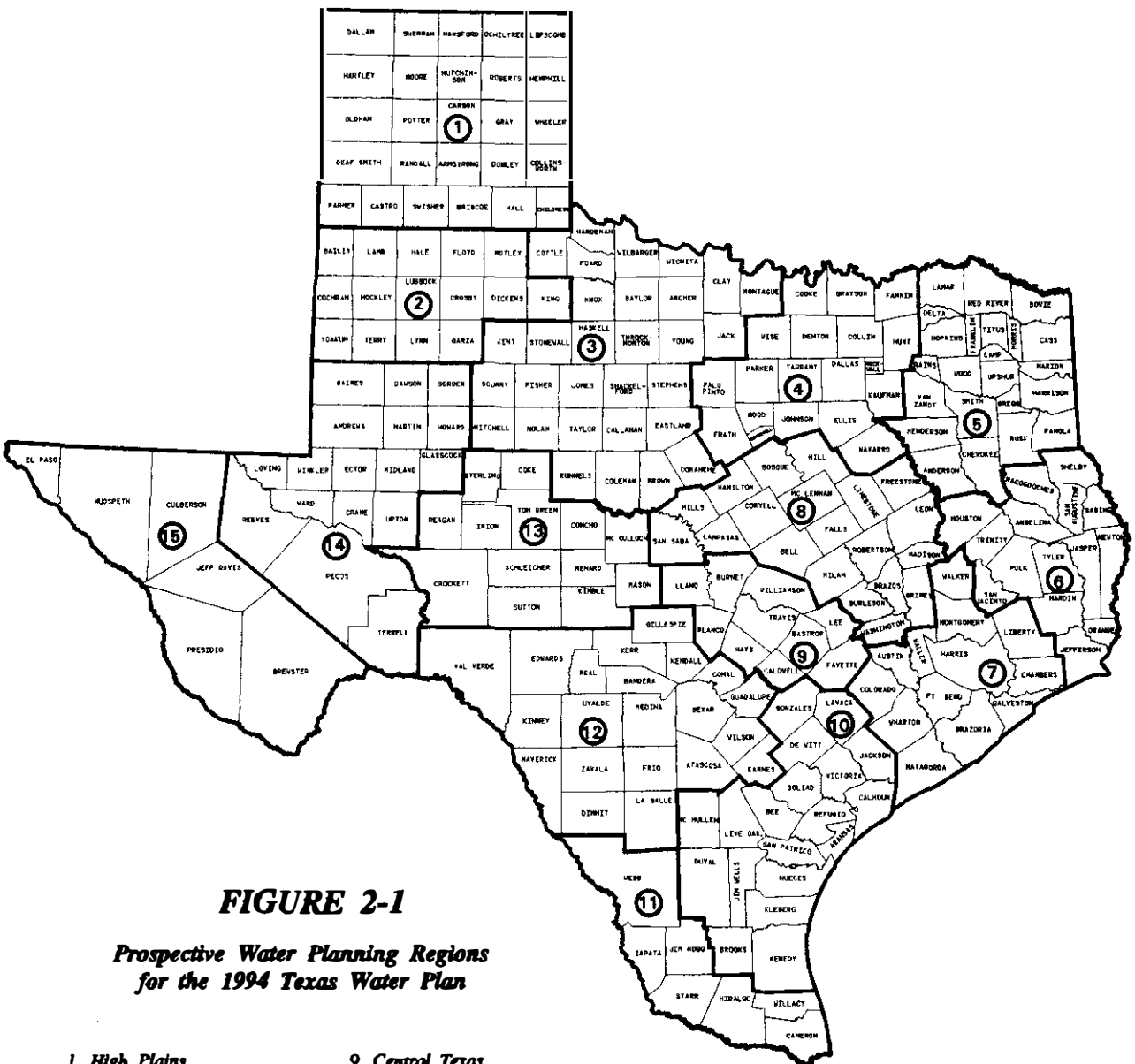
As referenced in the 1990 Water Plan, the Board initiated an in-house study of delineating new regions for better water problem analysis in the next update of the Water Plan (anticipated in 1994). The eight regions used in previous water plans were primarily determined by similar economic conditions in the boundary delineations rather than a "weighted" consideration of factors that represent similar water-related problems.

Certain regulatory and analytical constraints face Board staff in developing a preliminary determination of new regional boundaries. The most significant constraint relates to passage of Article V, Section 120 of the General Appropriations Act of the 72nd Legislature which specifies the development and use of ten "uniform service regions" for state government regulatory and services purposes. While Board staff would prefer to utilize study boundary definitions based on a concept of "common water problem" areas, the Board, in complying with this new regulatory requirement, must use the ten general regional areas based along the boundaries of underlying regional Councils of Governments (COGs). A minor amount of leeway was provided in the Legislation to eliminate subdividing lines within the specified ten major regions as long as it did not split COG boundaries or total more than 24 separate regions. With these constraints, Board staff assessed whether or not subdividing the major regions under these guidelines would provide any more specific delineation of common water problems.

While not well suited for water-related assessments, Board staff have reached a determination of the new regional delineations for use in the 1994 Water Plan (see Figure 2-1) that are consistent with the requirements of the new uniform state services regions. Public comment was considered in the development of these boundaries prior to their finalization and contemplated use in the 1994 Water Plan.

### 2.2 DEMOGRAPHIC/ECONOMIC FACTORS AND WATER DEMAND PLANNING

The Board regularly reviews and maintains all TWDB projection series relating to water needs assessments as new data and information become available. Of particular concern is changing patterns of population and economic growth in relation to water use patterns for the municipal, industrial, and agricultural sectors. The patterns of water use by the people and industries are impacted by factors such as changing demographic and economic conditions, climatological conditions, and more efficient use of existing water resources. In order to meet the requirements of the two-year update review, Board staff prepared and evaluated preliminary demographic, economic, and water use projection series following the release of the 1990 Census count estimates to see if significant changes had occurred that may warrant an update of the Plan. Significant changes, as defined in the introduction section, relate to recent changes that may significantly impact the water resources plans or projects developed for local geographical areas over the next 30 years in the 1990 Water Plan.



# *FIGURE 2-1*

***Prospective Water Planning Regions for the 1994 Texas Water Plan***

1. *High Plains*
2. *South Plains*
3. *West Central Texas*
4. *North Central Texas*
5. *Northeast Texas*
6. *Deep East Texas*
7. *Gulf Coast*
8. *Heart of Texas*
9. *Central Texas*
10. *Coastal Bend*
11. *Lower Rio Grande*
12. *Edwards/Winter Garden*
13. *Concho Valley*
14. *Permian Basin*
15. *Upper Rio Grande*

### 2.2.1 Population and Municipal Water Demand Forecasts

The Board's adopted population forecasts, prepared in 1989 and utilized for the 1990 Water Plan, were reviewed in relation to the previous underlying assumptions of the 1989 forecast associated with the anticipated growth of the State's population over the next 30 years and in relation to the recent 1990 Federal Census count. In the Board's review process, a particular concern to our staff and other professional planners around the State and U.S. is the accuracy of the official 1990 Census count, as finally adopted by the U.S. Department of Commerce. Following the field work and early compilation of the 1990 Census count, the U.S. Bureau of the Census published limited information developed from the Bureau's Post Enumeration Survey to determine the accuracy of the 1990 Census field count.

The results of this survey showed that the population of Texas may have been undercounted by 564.5 thousand residents, which would increase the count from 16.986 million residents from the Census field surveys to a statistically-adjusted 17.551 million residents (a 3.3 percent difference). The 17.551 million adjusted estimate of the Bureau of Census compares very well with the Board's 1990 high-case estimate of 17.562 million residents (a difference of only 11,000 residents or a percentage difference of 0.06 percent). Counties having a population of 100,000 or more residents were identified by the Bureau as having a possible undercount totalling approximately 451,000, or 80 percent of the statewide undercount. Unfortunately, these counties having 100,000 or more population are the major municipal water use centers throughout the State.

The concern over another undercount of the State's population (similar to the recognized 1980 population undercount of approximately 540.0 thousand residents) became most evident as the State of Texas filed suit against the U.S. Department of Commerce regarding the alleged 1990 undercount and the potential loss of millions of Federal dollars to the State.

While the Board's forecasts for 1990 compare very favorably with the statistically-adjusted Census count, the officially-adopted 1990 Census count of 16.986 million residents for Texas was 576,000 less than the TWDB forecast of 17.562 million residents (a 3.4 percent difference). Recently-released Census estimates for Texas' 1991 population (17.5 million persons) now reflect the approximate 17.5 million people shown in the rejected adjusted estimates for the 1990 population. A comparison of the high-case scenario population forecast for the 1990 Water Plan and the Board's more recent preliminary high-case scenario forecast using the questionable 1990 adopted Census data estimates are as follows:

| Year | 1990 Water Plan | 1991 Preliminary Forecast Using Adopted Census |
|---|---|---|
| 2000 | 21,016,408 | 20,230,204 |
| 2020 | 28,425,539 | 27,011,723 |

By the year 2020, the difference in the two forecasts results in a discrepancy of about 1.4 million persons, or 5 percent. The majority of this difference is due to two major factors affecting the forecasts for metropolitan areas: (1) lower initial 1990 beginning populations in forecasts based on the adopted, but likely undercounted, Census, and (2) lower initial growth rates in the adopted Census-based forecast resulting from the 1990 Census count producing unusually low 1980-1990 migration rates, which were used as guidelines for projecting future migration. The combination of lower starting values of 1990 population, coupled with a lower initial growth rate, produces a noticeable difference over the 30-year projection period.

Due to the uncertainty of the viability of the adopted 1990 Federal Census count, the existing State-Federal litigation concerning these important figures, and the extremely close comparability of the Board's 1990 forecasts with the statistically-adjusted Census count, the Board feels comfortable using the 1990 Water Plan population forecasts for facility planning purposes until the next few years of annual Census estimates become available. At this later point, the likely settlement of the current State-Federal litigation and the availability of additional annual Census population estimates should provide a better setting for a more clear assessment of any needed update changes.

Major water resource development, including reservoirs, well fields, water and wastewater treatment facilities, and distribution and collection systems, is generally dependent on current and anticipated future municipal and industrial water requirements. A review of the particular population and water demand forecasts for individual municipalities indicates that the difference in the previous 1990 and most recent 1991 preliminary forecasts of municipal water demand are not significant enough to warrant a wholesale change in the water projects identified in the 1990 Water Plan for addressing local and regional water problems. In a few particular instances discussed in the Area Assessment Section that follows, more specific local knowledge of significantly changed conditions has resulted in recommendations for amendments to the proposals for a limited number of municipalities.

### *2.2.2 Industrial Water Demands*

Water use patterns in manufacturing over the next 30 years identified in the 1990 Water Plan were reviewed in relation to the preliminary industrial water demand forecast. Statewide, manufacturing water use increased by 184 thousand acre-feet from 1986 through 1989. This increase was the result of the resurgence of the petro-chemical industry, accounting for about 58 percent of the overall growth in statewide manufacturing water use. Currently, five (5) industries account for approximately 90 percent of the State's manufacturing water use: Chemical and Allied Products; Petroleum Products; Pulp and Paper Products; Food and Kindred Products; and Primary Metal Products.

Events that were anticipated to have significant impacts on manufacturing growth for the planning period of the 1990 Water Plan still appear to be relevant, with the exception of the North American Free Trade Agreement (NAFTA). Most analysts agree on which industries will benefit

and which industries will be negatively impacted should the trade agreement be enacted. Industries such as apparel, textiles, leather, and some food processing should be impacted by lower labor costs presently in Mexico with most other industries benefiting from the anticipated increased trade with Mexico (see area assessment on "North American Free Trade Agreement" in Section 4.1.6). Consequently, industries identified to exhibit slow and relatively higher growth over the planning period still appear to be valid. Those industries anticipated to experience relatively moderate to high growth over the planning period are plastics, electrical machinery, non-electrical machinery, paper products, and chemicals while manufacturing industries such as textiles, leather, apparel, primary metals, and various food products are anticipated to experience slow growth over the 30-year planning period.

A preliminary revised forecast of manufacturing water use for the Water Plan update reflects a slight increase (8,000 ac-ft by 2020) over the previous forecast done in 1989 due to minor modifications to anticipated demands for the chemical industry in relation to expansion of facilities primarily along the Gulf Coast. However, the differences are not significant enough to change the previous water projects presented in the 1990 Water Plan.

Preliminary revised forecasts of steam-electric power generation and mining water demand are slightly less than the forecasts presented in the earlier 1990 Water Plan. This slight reduction in water requirements for steam-electric power reflects slower population growth (utilizing the likely-undercounted 1990 Federal Census) and associated residential electric demand embodied in the preliminary 1991 projections for this water-use sector. The reduction in water demand for mining is indicative of anticipated slightly slower growth in: (1) construction-related materials demand as contrasted to the higher levels of residential construction experienced during the 1980s, and (2) energy-related mining activities, such as oil, coal, etc.. The slight reduction in water demands for these two water-use categories are insignificant compared to the other major water use categories and should not affect the need for any projects identified for local areas in the 1990 Water Plan.

### *2.2.3 Agricultural Water Demands*

A review of the agricultural water-use projections have utilized more recent historical data. At the time of preparation of the 1990 Plan, only 1988 irrigation-use data were available. In the 1990 Plan, the 1990 data was, by necessity, a projected value. In the 1992 Plan, the actual 1990 data from the Board's annual survey estimates of water use are used. With actual data for 1990, the projection trends for the year 2000 were adjusted in some instances, with the later years' trends remaining the same as before.

After reviewing the 1990 actual data, the projections in the Plan were adjusted in a few counties where the 1990 data indicated a definite change from what was forecasted earlier. Regional totals remained essentially the same except for the Winter Garden - Edwards Aquifer area. This area has been under serious study, and the projections of high level demands were

revised to that of the highest current acreage and water use with appropriate reductions for conservation practices implemented by the years 2000 and 2010.

## 2.3 WATER SUPPLY PLANNING

The Board is continually conducting reviews, studies, and evaluations of new information to update estimates of current and future water supply availabilities across the State. In some cases, analytical studies performed in-house by TWDB staff, by others through Board planning grant studies, or by others independently, shed additional light on the availability of surface and ground-water supplies or how those supplies might be allocated to demand centers. In other cases, regulatory actions taken concerning water rights, ground-water protection, or water sales contract decisions can also affect supply availabilities and allocations. Since the 1990 Water Plan, some new supply studies were initiated, some studies that were underway were completed, and some studies are still in progress. Further information has become available in several areas as it affects major water supplies. In addition to reservoir development, the 1990 Texas Water Plan and this update consider a number of other potential water supply sources (see policy discussion under Alternative Water Supplies beginning on page 18). Some local entities caution against undue reliance on this approach, and recommend that the plan not limit the number of potential reservoir sites.

Concerning surface water supply planning, additional modeling of existing or potential new surface water options for the Southern Edwards Aquifer Region has been completed. In-house studies at the Board have examined the potential optimum reservoir project at the Lindenau Reservoir site as if it were to be built as a stand-alone project with diversions from the Guadalupe River and adjusted to a pool elevation that protects certain environmental features. Assessments of potential additional supplies from the Goliad Reservoir project have also been made concerning use of return flows from the San Antonio River in addition to the possible reservoir project's own yield. The U.S. Bureau of Reclamation has also recently completed a study of the Lake Medina project, which provides additional data on the potential firm yield of the project's supplies.

Board and local entities are also commencing the initial stages of a major cooperative study of the feasibility of using surplus East Texas water supplies to meet the growing shortages and water needs of the Houston metropolitan area and the Central and South Texas regions.

Based on Board initiatives and recommendations by an Outside Technical Advisory Panel, efforts have been essentially completed to modify and update the Board's Edwards Aquifer model to reflect monthly time-step simulations and other new features and data. Also, draft results from additional Board modeling of the Ogallala (High Plains) Aquifer have resulted in slightly adjusted supply availability estimates. The Board is also modifying a model provided by the USGS (the RASA model) to better evaluate supply availabilities in the Gulf Coast and Carrizo-Wilcox aquifers and should have additional supply information ready for use in the 1994 Water Plan. Models of the Cenozoic Pecos Alluvium and Woodbine aquifers are also in development. An exciting new development in the evaluation of ground-water supplies in Texas involves the application of the

Board's new Geographic Information System (GIS) capabilities in our ground-water modeling data input/output handling and evaluation.

Also related to groundwater, studies or actions for possible designation of Critical Areas that have occurred since the 1990 Plan are at various stages of completion as follows:

Table 2-1
Status of Critical (Groundwater) Area Process Since the 1990 Water Plan

| Designated Critical Area # | Action | Report | Comment |
|---|---|---|---|
| 1 | Reports Published After 1990 Texas Water Plan | R326 (Jan 91) - Bell, Burnet, and Travis counties | |
| 2 | | R339 (in review) - Hill Country Counties of Central Texas | |
| 15 | | R330 (Jul 91) - Southern High Plains | An existing district in Martin Co. annexed portions of Howard Co., and the district was renamed the Permian Basin UWCD. Remaining part of Lynn Co. was added to the High Plains UWCD #1. In 1992, the South Plains UWCD, encompassing Terry County, was created. |
| 16 | | R337 (Mar 92) - Rolling Prairie Region of N. Central Texas | |
| 14 | | R334 (Oct 92) - Winter Garden Area of S. Central Texas | |
| 9 | TWC Declared Critical Areas | R315 (Nov 89) - Dallam County | no district yet formed |
| 4 | | R313 (Feb 89) - Briscoe, Hale, and Swisher counties | no district yet formed |
| 3 | | R312 (Feb 89) - Midland, Reagan, and Upton counties | Santa Rita District (1989) and Glasscock Co. District (1981) included that portion of Reagan County which was included in the Critical Area. |
| 2 | | R339 (in review) - Hill Country counties | Springhills Water Management District (1989) included Bandera County. Headwaters UWCD (1991) formed which included Kerr County. Hill Country UWCD (1987) formed which included Gillespie County. |

While these declared Critical Areas noted above have been designated by TWC administrative action, no districts have yet been created by the administrative process and provided to local voters for confirmation consideration (see Section 3.3.1 for more background). The District formations shown above were accomplished through legislative action.

## 2.4 FACILITY NEEDS/COST PLANNING

Since the 1990 Water Plan, Board staff have conducted more than 975 visits to Texas utilities, in part to gain additional or better information on prospective facility needs. Board staff have also updated facility needs information on approximately 500 wastewater utilities. As discussed elsewhere in the Update, Board staff have also conducted a field survey of eligible counties in the Economically Distressed Areas Program, identifying almost 1,200 separate colonia-type communities. As a result of these data and updated cost information, the Board has revised its forecast of prospective water-related facility needs costs. Whereas the 1990 Plan identified approximately $37.163 billion dollars of 50-year facility needs ($17.643 billion water and $19.521 billion wastewater), more comprehensive, recent estimates of the future needs from 1992 to the year 2040 are as follows:

Table 2-2
Prospective Water-related Facility Needs Costs, 1992-2040
(Billions of 1992 Dollars)

| Facility Type | 1992-2000 | 2001-2040 | Total |
|---|---|---|---|
| Reservoir/Conveyances | $ 1.939 | $ 3.079 | $ 5.018 |
| Water Utilities | $ 5.076 | $ 9.466 | $14.542 |
| Wastewater Utilities | $ 5.322 | $14.187 | $19.509 |
| Total | $12.337 | $26.732 | $39.069 |

## 2.5 ENVIRONMENTAL PLANNING

The tidal lands and waters of the State's coastal region are recognized as one of our most important natural resources. Management of these bay and estuary systems requires continual data collection efforts, coupled with an analytical study program to determine the effects of and needs for freshwater inflows to maintain their ecological health. Under the joint leadership of the Board and the Texas Parks and Wildlife Department, in cooperation with the Texas Water Commission and other State and Federal agencies, intensive inflow surveys were performed on Galveston Bay and the Trinity-San Jacinto Estuary (1989), Sabine Lake and the Sabine-Neches

Estuary (1990), Baffin Bay and the Laguna Madre (1991), and the Christmas Bay Coastal Preserve (1992). In addition, the Board and the Department also completed a multi-year comprehensive report effort entitled Freshwater Inflows to Texas Bays and Estuaries: Ecological Relationships and Methods for Determination of Needs (1992) for use in the planning and management of these valuable environments. While the initial report has been completed, a number of policy and analytical issues remain to be decided before a more complete determination of environmental water needs for the bays and estuaries can be provided for regulatory consideration.

Consideration of the environmental aspects of potential alternative water supply projects is also an important part of the Board's revision of the State Water Plan. As a result of these considerations, the Board and the Department are jointly performing terrestrial and aquatic surveys of potential future reservoir sites, such as Cuero (1990), Lindenau (1991), and Cibolo (1992) sites in South-central Texas. The purposes of the environmental surveys are to develop an inventory of the plant and animal species that might be affected by construction and to provide ecological data that will be useful in evaluating the instream flow needs of fish and wildlife living downstream from the project sites.

## 3.0 POLICY CONCERNS

Texas Water Development Board staff examined various recent water issues facing the State and those discussed in the 1990 State Water Plan to determine changes that have occurred following its publication in December 1990. Observed changes are listed in the following discussion. Changes affecting potential water policy may include legislation passed by the 72nd Texas Legislature in regular or special session, regulations, agency actions, court decisions, and socioeconomic trends. In some instances, actual or proposed U.S. Executive or Congressional actions are examined.

To assist staff in evaluating the significance of policy issues and the often rapid changes that have occurred, TWDB sought input from a number of sources. The Texas Water Development Board mailed out approximately one hundred letters seeking background information on the relative importance of policy issues, alternative responses to address identified problem areas, and other issues that should be considered in the Water Plan. Additionally, the Board, in conjunction with the Texas Water Resources Institute, sponsored a workshop to identify priority water research topics. Based on the results of these two efforts, staff developed a preliminary list of 15 issues for consideration.

This list was reviewed by a 19-member Outside Advisory Panel. The panel identified the following issues as priority issues: water financing, protecting surface water quality, ground-water supply source management, drought/demand management, environmental uses of water, and flood protection/damage reduction. Subsequently, the Advisory Panel has provided information to TWDB on problem descriptions, alternatives and recommendations for each of these priority issues.

The Outside Advisory Panel only reviewed the priority issues listed above and panel recommendations are listed in this report. Panel assistance in preparing the update does not imply endorsement of other findings and recommendations of the report. The ensuing Chapter provides specific information concerning these priority policy issue and other issues: a background discussion, recent events, 1990 Water plan recommendations, and significant issues that are new or still unresolved.

A wide array of persons from State, Federal, and local governments and the private sector were invited to participate in the Outside Advisory Panel. During the final meeting of the Panel on September 30, 1992, those attending the meeting expressed a desire to list the names of the Panel Members. Those following persons or their representative participated in one or more meetings of the Panel.

## PARTICIPANTS IN THE OUTSIDE ADVISORY PANEL

Ms. Catherine Perrine*
Water Issues Coordinator
League of Women Voters

Mr. Ken Kramer*
Director
Lone Star Sierra Club

Mr. Monte Akers*
Assistant General Counsel
Texas Municipal League

Mr. Carl Riehn
General Manager
North Texas Municipal Water District

Ms. Andrea Morgan*
Office of the Lieutenant Governor
State of Texas

Ms. Claudia Olson*
Office of the Speaker of the House
State of Texas

Mr. Roy Roberts*
General Manager
Brazos River Authority

Mr. Steve Stagner
Lloyd, Gosselink, Fowler, Blevins & Mathews

Dr. Ray Perryman*
Perryman Consultants

Mr. Tom Masterson
Masterson Moreland Sauer Whisman Inc.

Dr. Ernest Gloyna*
Department of Civil Engineering
University of Texas

Mr. Philip Becker*
Association of General Contractors

Mr. Mike Personett*
Texas Water Commission

Mr. Bill Couch*
General Manager
Barton Springs-Edwards Aquifer Conservation District

Mr. Barry Rought*
Chief of Construction and Operations
Southwest Division Regional Office
U.S. Army Corps of Engineers

* Person or their representative attended last meeting of Outside Advisory Panel to finalize consensus opinions.

This list was reviewed by a 19-member Outside Advisory Panel. The panel identified the following issues as priority issues: water financing, protecting surface water quality, ground-water supply source management, drought/demand management, environmental uses of water, and flood protection/damage reduction. Subsequently, the Advisory Panel has provided information to TWDB on problem descriptions, alternatives, and recommendations for each of these priority issues. The ensuing Chapter provides specific information concerning these priority policy issues and other issues: a background discussion, recent events, 1990 Water Plan recommendations, and significant issues that are new or still unresolved.

Implementation status is reviewed for each 1990 State Water Plan policy recommendation. In those instances where the 1990 Water Plan recommendations have been fully implemented, the 1992 Plan recommendations will not repeat the achieved actions. All 1990 Plan recommendations shown as partially implemented or not implemented remain in effect. The 1992 Plan recommendations that are either new or necessary due to changed conditions are presented in this Chapter following the sections entitled "Relevant 1990 Water Plan Issues and New Issues."

The recommendations are denoted as follows:

- ⋆ Recommendations by Board staff are represented by the small star symbol, and
- ★ Recommendations of the Outside Advisory Panel are represented by the large star symbol.

In most instances, the staff recommendations are listed first, followed by the Outside Advisory Panel recommendations, if any, in the recommendation section for each issue.

## *3.1 ALTERNATIVE WATER SUPPLIES*

In an era of ever-increasing resource scarcity and more stringent environmental regulation, various more non-traditional means to providing for future water needs should be examined and implemented where feasible and practical. These more innovative methods, termed "alternative water supplies" for this discussion, can involve both structural and non-structural approaches for meeting current or future water needs that may preclude construction of potentially more expensive or environmentally-impacting new surface water reservoirs.

**Recommendations for Amendment of the Water Plan**

⋆ The Governor, Lt. Governor, and the Speaker of the House should designate an Advisory Committee to review the existing State water allocation system to determine its effects on efforts to efficiently meet future water demands, maintain and improve water quality, and protect fish and wildlife resources. Consideration should be given to existing State law, legal precedent, State agency rule-making/implementation, and other states' experiences concerning historical and new approaches to water allocation procedures. The Board has commissioned

a study of innovative water reallocation, marketing, and transfer mechanisms which should provide a substantive background platform for committee considerations and recommendations to the Legislature. The Board should analyze and develop recommendations for alternative State and regional institutions, such as water banks, that could facilitate water rights or water sales transactions.

★ The State of Texas should aggressively pursue water conservation and related efforts to stretch availability and use of existing surface water supplies; examine the feasibility of interbasin transfer of water and water rights as mechanisms for providing demonstrated need for surface water; encourage conjunctive use of surface and ground water to maximize availability of supplies; enhance system operations of surface water reservoirs to maximize yields; assist the development of the proposed surface water reservoirs listed in the 1990 water plan when there are demonstrated needs for that water which may not be met in alternative ways and where adverse environmental impacts can be mitigated or avoided.

### *3.1.1 Water Conservation*

In 1985, the 69th Legislature redefined water conservation in the Texas Water Code to include both the development of water resources and those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for current and future consumptive and non-consumptive uses. The recommendations in this policy section pertain to various water demand and supply management approaches that can be implemented to ensure that a sufficient supply of good quality water is available for the future of the State.

**Actions Since Adoption of the 1990 Water Plan**

- Texas Senate Bill 587, effective January 1, 1992, requires that all plumbing fixtures manufactured or distributed for sale in the State meet certain maximum flow standards for water conservation as well as product labeling requirements in accordance with rules and regulations adopted by the Texas Water Commission (previously, the responsibility of the Texas Department of Health) for certain types of water-using appliances. The Commission will maintain a list of plumbing fixtures that meet the established standards and will publish the list quarterly in the Texas Register.

- The Governor's Executive Order, dated February 26, 1992, supports the omnibus recycling bill (SB. 1340) pertaining to conservation of natural resources, reduction of energy and water consumption, waste generation reduction, and promotion of recycling in Texas. The Order states that in order to reduce the consumption and waste of water, state owned and operated facilities should initiate the following procedures:

  1. establish efficient water-use operation and maintenance policies for all facilities, including education and training programs for facility managers and employees;

2. begin landscaping utilizing low-water-use concepts such as Xeriscaping™;

3. design future facilities and properties with water conservation in mind; and

4. to the extent practicable, maintain monthly water-use records for each water-using facility according to activity or type of water use. Periodically review records to identify problem areas such as leaks, and determine the feasibility of programs to reduce wasteful and inefficient use.

The Board is specifically charged to provide information on developing plans and instituting programs to increase the efficiency of water use and reduce the waste of water, including providing training workshops and materials. The Board is also considering conducting programs or studies to evaluate the cost-effectiveness of retrofitting existing State-owned or controlled facilities with more efficient water-using fixtures, appliances, and equipment.

- The Texas Water Development Board received a three-year grant, totaling $750,000 for the first two years, from the Governor's Energy Office (from Oil Overcharge Settlement Funds) to conduct a number of water conservation programs emphasizing utility system leak detection and a variety of public education activities.

- The Board, in cooperation with the Governor's Energy Office and the Lower Colorado River Authority (LCRA), funded a landscape irrigation auditors training program which was developed by the Texas Agricultural Extension Service. The course and technical training manual form the basis for implementing efficient, large-scale landscape irrigation techniques which can achieve significant reductions in outdoor water usage if properly applied.

- The Agricultural Water Conservation Bond Program was authorized and the Board adopted rules to implement its Agricultural Water Conservation Loan Program under the Bond Program authorization. Texas Senate Bill 1197, passed by the 72nd Legislature, authorized the Board to use funds from the interest and principal repayments from the previous Pilot Loan Programs for a wider variety of purposes. These new purposes include directly loaning the money through the Agricultural Water Conservation Loan Program. This has allowed the Board to begin making loans through this program, while the question of the taxable nature of the bonds used to provide loan funds for lender districts is still being pursued with various members of the U.S. Congress.

- TWDB, through the Research and Planning Fund, is funding research projects to (1) develop, test, and evaluate methods for monitoring the quantity of savings that result from agricultural water conservation in rice crops, and (2) evaluate water conservation savings and cost/benefits of residential Xeriscape™ landscapes.

- The TWC on October 30, 1992 published in the Texas Register a proposed new Chapter 288, "Water Conservation Plan, Guidelines, and Requirements." Additionally, TWC proposed changes to rules to clarify the requirements for water conservation plans submitted with water use permit applications, and to clarify the procedure for review and approval of water conservation plans.

- TWC proposed rules include provisions (§297.56) to address concerns associated with possible cancellation or forfeiture of conserved water.
- TWC is developing technical assistance to utility operators in conserving water.
- The 1990 Water Plan includes a recommendation to "Authorize TWC to require a water conservation program by applicants for a wastewater discharge permit." Since that time, TWC has been examining integrating water conservation into TWC water utilities administration.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Establish a certification program to set maximum flow standards for plumbing fixtures and appliances purchased for use or sold within the State. | ✓ | | |
| Texas Legislature should consider incorporating water conservation policy goals into all appropriate activities and programs of State government. | | ✓ | |
| All State agencies responsible for water conservation activities should ensure consistency of water conservation information provided to the public and water conservation program requirements being encouraged or enforced. | | ✓ | |
| TWDB and TWC should enact a Memorandum of Understanding (MOU) which clearly establishes that fulfilling the water conservation program requirements of one agency will satisfy the requirements of the other. | | ✓ | |
| Authorize TWC to require a water conservation program by applicants for a wastewater discharge permit. | | | ✓ |
| Authorize TWC to require a drought contingency plan as part of a water rights or wastewater discharge permit approval. | | | ✓ |
| TWC should begin a program to require existing permit holders to implement water conservation programs and to prepare drought contingency plans within a two-year period. | | ✓ | |
| Ensure legislative directives are included in the Water Code to provide that water authorities and districts develop/institute water conservation programs to address local/regional needs. | | | ✓ |
| Fund TWDB to increase its water conservation education and technical assistance activities. | | ✓ | |
| Make further efforts to encourage and facilitate implementation of water conservation measures in irrigated agriculture. | | ✓ | |
| Fund TWDB and TWC to evaluate changes in water and wastewater system facilities planning and construction standards to reflect operational efficiencies and cost savings achievable through water conservation. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- Although many State and local conservation efforts are increasing, additional follow-up actions are still needed to incorporate water conservation into water programs of the State and to encourage more comprehensive coverage of effective water conservation activities for all water users.

- A need continues to enhance existing programs to provide technical assistance to those local and regional entities that have already undertaken water conservation activities, and to encourage those entities that have not fully incorporated water conservation into local water planning and development to do so.

- With funds from the Governor's Energy Office, the Board has been able to enhance some of its outreach programs for water conservation. However, the water conservation education and technical assistance activities conducted by Texas State agencies continue to be limited when compared to the activities of several other large water-using states.

- Data collection, research, and information development on water conservation is still insufficient at all levels of government. It is particularly important that the State develop standardized information on how to incorporate the effects of water conservation programs into long-range water plans and capital facility investment plans.

- In response to increasing water, wastewater treatment, and overall energy costs, as well as certain environmental costs, many industries use water more efficiently today than ever before. There appears to be the opportunity for additional savings, especially in smaller manufacturing operations. Specific practices which may yield additional water savings include process modification or substitution, use of saline water or treated wastewater in cooling processes, air cooling or recirculation cooling systems, energy conservation, waste heat recovery, modern process control, and proper system operation and maintenance.

- A certain amount of caution must be exercised in mandating or recommending substantial manufacturing and industrial water conservation practices. Water-efficient processes must also be cost-effective in order to produce goods at competitive prices. Industries that can save the most money through increased water use efficiency, those industries in areas of water supply shortages, and those planning process or equipment replacement for other reasons will be most likely to initiate conservation programs.

- The Board intends to finance research into better understanding of industrial water usage, including analyses of usage per-unit of production, through the Water Research and Planning Fund. These studies are intended to expand existing knowledge of the relationship between various water-using processes, costs, and production in different industrial applications. They may also help discover methods for waste minimization through process re-design and control. Ultimately, this research should help determine the extent to which industrial water conservation can be expanded and what type of net water savings can be practically achieved.

**Recommendations for Amendment of the Water Plan**

- ★ The Legislature should consider clarifying its intent with respect to the 1985 water conservation directives contained in House Bill 2. Specifically, clarification should be made as to whether the Legislative charge would allow the Commission to require water conservation programs of existing permit holders.

- ★ The Texas Water Commission should continue its efforts to incorporate water conservation initiatives into its water-related regulatory programs. The 1990 recommendation on extending conservation requirements into the TWC's wastewater permitting program should be replaced with a broader recommendation to review the legal authority, comprehensiveness of program coverage, and funding mechanisms to ascertain the appropriate mechanism for extending these requirements into other TWC regulatory programs. To encourage conservation with a minimum of regulatory administration, consideration should be given to the incorporation of measures-based approaches to conserve water as key elements of required conservation plans. Measures-based approaches could include such actions as Legislative requirement of conservation-oriented (non-waste-inducing) rate structures, maximum acceptable levels of utility system water loss, etc. In providing this type of flexibility, TWC would encourage conservation programs tailored to the specific needs of an area without the need for additional staff time to review and comment on detailed plans for every municipality in the State.

- ★ The Commission should also provide for adequate monitoring and enforcement of the Water-efficient Plumbing Act provisions passed in the 72nd Legislative session.

- ★ In order to encourage implementation of water conservation measures, financial incentives should be considered by the Legislature. These could take the form of State financial assistance to political subdivisions for the establishment of rebate programs for installation of water-saving fixtures. Alternatively, financial incentives to individuals to defray the cost of conservation measures, including retrofitting, could be incorporated into the Federal tax code.

### *3.1.2 Water Reclamation, Reuse, and Effects on Water Rights*

Reuse of reclaimed wastewater is a viable method of increasing the usefulness of a limited water supply. Major constraints to reuse fall into five main categories: economic, health, legal, institutional structures, and public understanding. The economic issue is really the same as for any water supply alternative, whether it is economically feasible to develop a reuse system, taking into account the need for additional treatment, possible separate distribution systems, permitting costs, and other factors. These economic issues should be addressed in the same manner as other water supply economic considerations.

However, an additional factor is the possible need for economic incentives for reuse in a system where it is not economically cost-effective, in order to benefit another user for which efforts are economically justified. Thus, the economic evaluation of reuse must be conducted in a more comprehensive manner, including the potential for water marketing. For example, it may be more cost-effective for a new community to reuse greywater combined with overland runoff for lawn-watering than to treat additional water to potable levels for that purpose. This would be

particularly true if users down-stream benefitted by having additional water of higher quality for use in limited flow periods. In such an instance, a comprehensive economic analysis might suggest that the users down-stream should well consider participating in the cost of a separate distribution system for greywater reuse in the new community.

Health-related issues remain a concern with the local use of greywater systems. Although the TWC has adopted rules specifying the quality standards for certain types of reuse activities, the use of greywater systems remains limited due to costs and possible legal jeopardy. Also, water rights issues involving return-flow requirements may significantly complicate the implementation of such systems, especially large-scale reuse projects.

**Actions Since Adoption of the 1990 Water Plan**

- Texas Water Commission rules, 31 Texas Administrative Code (TAC) Sections 310.1-310.18, governing the use of reclaimed water, specify that approval by the Executive Director does not affect any changes to existing water rights, and that if water rights are an issue, a separate water rights authorization from the Commission must be obtained. This provision could limit the reuse of greywater or reclaimed wastewater where the water supply source has quantities specified for return flow or instream flow requirements. This would not be a major constraint where reuse led to lowered levels of potable water usage.

- Texas Water Commission rules, 31 Texas Administrative Code (TAC) Sections 305.126(b)-(c) require that permittees of domestic wastewater treatment facilities with a permitted daily average effluent flow equal to or greater than 500,000 gallons per day shall, within one year of issuance of any new, amended, or renewal permit, submit to the Texas Water Commission a study investigating the possibility of substituting reclaimed water for potable water and/or freshwater where such substitution would be both appropriate and cost-effective.

- A study to determine the feasibility of augmenting the yields of two existing reservoirs with return flows diverted from the Trinity River is currently being developed by the Tarrant County Water Control and Improvement District Number One with funding provided by the Board, the Research Foundation of the American Water Works Association, and the District itself.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Texas Legislature should consider adopting an official policy to guide State water reuse and recycling programs. | | | ✓ |
| Provide funds to TWDB, TWC, and TPWD to conduct a joint study on return flow needs of State streams and how those streams will be affected by increased reuse or, alternatively, additional use of freshwater supplies. | | | ✓ |
| TWDB and Texas universities should be funded to conduct further education activities to inform the public and water professionals about reuse options. | | ✓ | |

**Relevant 1990 Water Plan Issues and New Issues**

- The factors that determine whether a reuse application will be feasible are primarily economics, public (user) acceptance, and the applicable requirements for permitting. The objective of reuse promotion should not be to encourage reuse universally and indiscriminately where these factors do not favor reuse, but to first identify cases where the potential for reuse to be feasible is the greatest, then investigate that potential, and if positive, to educate the beneficiaries of its value, reliability, and benefit to them.

**Recommendations for Amendment of the Water Plan**

- ★ A systematic approach is recommended in which wastewater sources and potential markets for reclaimed water are identified and matched with the source on a statewide basis. The Board and Commission should enhance programs to encourage reuse options in all water supply planning efforts. Because of the potential supply volume involved, water reclamation and reuse should be given the same level of consideration, from a State water planning standpoint, as development of more traditional water resources.

- ★ The Legislature should consider providing the TWC, the Board, and any other appropriate parties with sufficient funding for expanded technical assistance and to more fully investigate and better define the potential for water reuse and associated effects upon downstream water rights and supply needs.

### *3.1.3 Desalinization*

The program to convert brackish and saline water resources to freshwater differs from other water development programs in that it offers the promise of developing an entirely new source of fresh water to meet municipal and industrial demands. The need for additional fresh water supplies has lead an increasing number of municipal and industrial users to consider desalting the known supplies of inland brackish and saline water and the inexhaustible oceans and seas. Recent research and development activities in desalting processes, especially reverse osmosis and electrodialysis, have reduced the cost of converting brackish and saline water to fresh water so that these processes are now being used commercially to provide municipal and industrial supplies of fresh water at about 650 locations in the United States, including approximately 80 in Texas, and about 1,600 other locations around the world. Data are currently available to delineate by location and quality the known brackish and saline ground and surface water in the State. However, additional studies are needed to determine the quantities available for development at various locations as well as the locations and quantities of wastewater available for municipal and industrial purposes through application of desalting technology. The evaluation of costs and the cost-effectiveness of desalting needs to be better identified and incorporated into long-range water supply plans as an alternative. Environmental effects, especially as related to brine disposal, also need to be considered in any evaluation.

### Actions Since Adoption of the 1990 Water Plan

- The U.S. Water Research Act of 1991, introduced by Senator Simon, proposes Federal funding for desalinization research and development.
- A solar pond project in operation for several years near El Paso, Texas, provides industrial process heat and electricity, and is the first in the world to produce potable water from a 5,000-gallon-per-day desalination system.
- The Governor's Energy Office is funding a project to examine the use of geothermal/geopressured energy for desalination.
- Advances have been made on furthering the funding for the bi-state Canadian River Chloride Control project.
- The Board and the U.S. Army Corps of Engineers are jointly funding additional research into options for controlling highly saline inflows into the upper reaches of the Brazos River.
- The Texas Water Resources Institute and the Texas Agricultural Experiment Station received funding in the summer of 1992 from the Board's Research and Planning Fund to evaluate reservoir systems operations in the Brazos River Basin by developing a stream/reservoir system simulation model that integrates water rights and salt concentrations.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| TWDB should evaluate brackish water availability and should conduct workshops with local governments and utilities on desalinization and its potential for extending freshwater supplies. | | | ✓ |
| TWDB and TWC (previously, TDH) should establish an agreement on the identification of areas where desalinization should be considered as the primary water supply option. | | | ✓ |
| Texas Legislature should consider supporting national efforts to promote desalinization. | | | ✓ |

### Relevant 1990 Water Plan Issues and New Issues

- ▸ Advancements in desalt technology, coupled with the rising costs of developing new supplies, have made the cost of desalinization more in line with conventional water treatment techniques.
- ▸ Given the location and amount of brackish and saline water that occurs in Texas and the increasingly limited supply of fresh water available to meet projected demands, desalinization needs to be further incorporated into the water supply plans developed in the State. In

particular, desalinization should be given careful consideration, where economically feasible, as a supply option in certain geographical areas.

**Recommendations for Amendment of the Water Plan**

★ No new recommendations are proposed beyond those in the 1990 Plan.

### *3.1.4 Reservoir Storage Reallocation*

During the past 30 years, water storage capacity of about one-half million acre-feet has been permanently reallocated from hydropower, navigation, and flood control storage to water supply purposes in seven U.S. Army Corps of Engineers reservoirs in Texas. However, the potential for reallocation in Federal projects to address future water needs has yet to be fully realized.

**Actions Since Adoption of the 1990 Water Plan**

- With Legislative approval, the Board established a new Hydrographic (sediment) Survey Program. Refer to "Reservoir Operations and Capacity Maintenance" (Section 3.2.2) for more information.
- A reallocation study is in progress for Lake o' the Pines by the U.S. Army Corps of Engineers.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| TWDB should acquire precise information on the actual authorized storage volumes in all Federal reservoir projects, conduct studies to determine amounts available for exchange or reallocation. | | | ✓ |
| TWDB should include storage volumes potentially available for reallocation in the Texas Water Plan. | | | ✓ |
| Amend the 1958 Water Supply Act to reassert Congress' intention to promote reallocation on the basis of original construction costs. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- ▸ Estimates of hydropower, navigation, streamflow augmentation, and flood control storage in Federal reservoirs are not readily available or are confusing.
- ▸ Engineering and economic studies to determine reallocation's potential and environmental studies to determine ecological impacts are complicated, expensive, and time consuming.

- U.S. Army Corps of Engineers repayment policy (not authorized by Congress) requires that water reallocated from existing storage be paid for as if it were being reconstructed today (replacement cost, rather than Federal government's actual or original cost).

**Recommendations for Amendment of the Water Plan**

- No new recommendations are proposed beyond those in the 1990 Plan.

### *3.1.5 Transfers and Marketing*

Reallocation of existing water supplies is an option for some areas of the State. There are a number of potential sources of water for reallocation. In river basins where water rights are fully appropriated, opportunities exist for shifting a portion of these water rights to higher value water uses. In some cases, water demands and supply availabilities within a basin are not geographically proximate, and in others, total supplies in the basin may exceed projected water needs of the basin. The surplus supplies could be made available to other areas within or outside of the originating basin. Further, expanded use of existing supplies could be facilitated by legal clarification of the viability of interim or temporary sale of these supplies to those in near-term need. Such legal clarification should address the ability to terminate such interim sales as well as how these temporary sales might affect the priority date of the water rights permit. Widespread implementation of conservation or water supply yield enhancement measures could free additional supplies for allocation. Some western states have added provisions into state water codes to encourage voluntary transactions between willing buyers and sellers of water rights. The primary example of a market in water rights in Texas occurs in the Rio Grande Basin where rapidly growing cities have purchased or acquired irrigation rights, and converted these to municipal rights.

Water transfers are described as a change in the nature of use, point of diversion, place of use or period of use of water. Interbasin transfers are increasingly being considered as a supply option for a number of areas of the State. Policy and technical issues associated with interbasin transfers include ensuring adequate protection of basin-of-origin interests; financing alternatives and cost-equity considerations; minimizing impacts on ecosystems from conveyance structures necessary for interbasin transfers; and better defining other ecological effects of transfers.

**Actions Since Adoption of the 1990 Water Plan**

- Adoption of S.B. 1059 removed the restriction on the Board of planning for interbasin transfers which contemplates or may result in the removal of surface water from the river basin of origin if the water supply is foreseeably needed in that basin over the next 50 years.

- TWDB is contracting with the Texas Agricultural Experiment Station to study selected water transfer and marketing issues. The contract scope calls for a review of existing water law, regulations, and institutions to determine the potential for and constraints on reallocations through marketing systems; development of criteria and values to be achieved by a water transfer system; review of the experience of other states in implementing water reallocation systems; and various methods to reallocate water saved through conservation practices. This

contract will implement 1990 State Water Plan recommendations and address one of the highest priority research topics identified at the 1991 Texas Water Development Board/Texas Water Resources Institute water research workshop.

- The Texas Water Commission has committed in its 1991 strategic plan to focus attention on enhancing transfer and marketing opportunities. The Texas Water Commission has also recently published a new report entitled, "Reallocating Surface Water in Texas: Facilitating the Development of Water Markets While Protecting the Public Interest."

- On July 22, 1992, the Sulphur River MWD was granted a permit by the Texas Water Commission to allow a temporary interbasin sale of 12 mgd of water supply to the Upper Trinity Regional Water District encompassing most of Denton County in the Trinity River Basin.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Amend the Texas Water Code to remove the requirement that the 50-year needs of a basin must be considered before planning for interbasin transfers of surface water. | ✓ | | |
| TWDB and TWC should review Texas water law and regulations for language that restricts water transfers and recommend to the Legislature any statutory clarification necessary to encourage voluntary water marketing and transfers. | | ✓ | |
| TWDB and TWC should jointly research the role of river authorities and other regional entities in encouraging the emergence of water markets. | | ✓ | |
| TWDB and TWC should study the feasibility of transfers between districts and cities in the Lower Rio Grande Valley and other areas in the State involving conserved water from canal improvements. | | ✓ | |
| TWDB and the Legislature should consider working to change Federal tax laws to make the Board's Agricultural Water Conservation Bond Program more effective. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- Some residents in water-abundant river basins have expressed concern about efforts to transfer large amounts of water from those basins to water-short areas.

- Establishment of water markets should not be considered a substitute for ongoing efforts to increase watershed yields or to conserve water.

- There is concern about the effects of water markets and interbasin transfers on downstream quantity and quality of flows as they may affect the health of aquatic, riparian or other environmental resources. Some interest groups argue that environmental water needs should be met prior to the provision of supplies for marketing or transfer purposes.

- Some agricultural and environmental interests may have concerns that a move to a more market-oriented approach to water rights would pit rural users and environmental interests against municipal areas, and that the large cities will have the resources to out-bid these other interests for water rights.

- The current interest in water marketing and transfers is a component of a larger issue: the ability within the current system of water rights administration to achieve goals of adequate water supply while protecting water quality and fish and wildlife resources.

**Recommendations for Amendment of the Water Plan**

★ In addition to evaluating the necessary legal infrastructure for transfers and marketing to occur, institutions to facilitate water transactions, such as a public water bank, are an issue for consideration. A "bank" could allow a public entity to market others' water rights as a clearinghouse function or even acquire water rights through purchase or lease for subsequent resale. For example, in Idaho, water banks re-allocate surplus Bureau of Reclamation project water. In California, the state in recent years established temporary banks to ensure supplies for water-short areas during drought conditions.

★ To supplement the recommendation from the 1990 Water Plan (page 4-11) encouraging the clarification of the ability to conduct temporary water sales transactions, the Legislature should also consider examining, and if needed addressing, the potential effects such temporary water sales may have upon loss of the water right priority date because of such permit amendments providing for the sale.

★ Regional and local water entities should consider methods for financing improvements to water transmission systems and other facilities of other entities in exchange to the rights to a portion of the water conserved or saved from this action. This approach should be further considered for non-facility-related conservation improvements, such as retrofit programs, financing for efficient irrigation systems, and other improvements for which savings can be documented and the rights to a portion of the saved water assigned to the entity funding the improvements.

### *3.1.6 Water Supply Yield Enhancement*

A variety of water supply management approaches are potentially available to locally increase the yield of a particular surface or ground-water supply source in select areas of the State over the long-term. Rainfall enhancement (weather modification), brush management, conjunctive use of surface and ground-water supplies, secondary recovery of ground water, utilization of playa lake water, ground-water recharge mechanisms, evaporation suppression, and other measures can all play a role in enhancing the yield of an existing water supply so that more of that supply is available for use.

The variety of water supply yield enhancement options can hold promise for certain situations, and the types of options used depend on the local water supply conditions. In some cases, multi-purpose yield enhancement projects can be developed such as combining flood protection features

with aquifer recharge capabilities. However, these types of watershed yield enhancement measures are typically not widely practiced nor uniformly implementable across the State.

### Actions Since Adoption of the 1990 Water Plan

- Water supply yield enhancement is an interim study topic for the Texas House Natural Resources Committee.
- Studies in the Nueces River Basin (Edwards Aquifer area) estimate that an additional 50,000 acre-feet per year could be recharged to the Edwards during average weather conditions, and possibly 20,000 acre-feet per year could be recharged during drought conditions using various recharge enhancement methods. The Edwards Underground Water District has funded a similar study, currently underway, in the San Antonio and Guadalupe river basins.
- A regional water supply planning study for the Kerr County area also examined the potential for storage of surface water in a "perched" or contained aquifer nearby for ultimate use during dry weather conditions.
- Private organizations are acquiring land for multiple purposes in the Edwards Aquifer recharge zone, including recharge and watershed and habitat protection.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| TWDB should review existing studies and conduct a comprehensive evaluation program, in conjunction with other appropriate State agencies, to identify areas where water supply yield enhancement might be beneficial and to further study the possible programs that could be instituted for those areas. | | | ✓ |
| TWDB, TWC, TPWD, TSSWCB, and other State agencies should conduct cooperative studies to determine the possible environmental effects of water supply yield enhancement measures, and develop guidelines for conducting implementation activities that fully consider environmental factors. | | | ✓ |
| Texas Legislature should consider methods to encourage watershed yield enhancement activities. | | | ✓ |

### Relevant 1990 Water Plan Issues and New Issues

- ▸ Water supply yield enhancement measures are still not widely practiced or uniformly implementable across the State.
- ▸ Potential costs and benefits, environmental effects, and regulatory feasibility of various water supply yield enhancement practices have not been entirely established.

- Increases in water supply due to many of the water supply yield enhancement measures are difficult to measure because of other intervening factors affecting the measurements of supply additions and water use. This can also make it difficult to allocate the costs of conducting such programs to the ultimate beneficiary.

- Issues related to use of these mechanisms will need to be resolved, such as environmental effects, water rights considerations, etc.

- Financing of water supply enhancement programs is difficult, both for the reasons stated above and because of the time frame that may be required before benefits of certain techniques are realized.

**Recommendations for Amendment of the Water Plan**

★ The TWDB should identify areas where conjunctive use of surface water and ground-water is feasible, and assist water users in developing plans for conjunctive use.

### *3.1.7 Review and Nonuse of Water Rights*

In 1990, the 72nd Texas Legislature passed HB 529 which revised the surface water rights cancellation statutes to be enforced by the Texas Water Commission. Current statutes state that the Commission may initiate water rights cancellation proceedings when it finds that some portion of the water has been used during the past 10 years. The cancellation proceedings can address all or part of the permit, certified filing, or certificate of adjudication. The new statute language clarified previous requirements that seemed to require the Commission to take action if the water rights were not put to beneficial use in a 10-year period. The effect of the new language will be to give water supply entities some assurance that they can plan for long-term water supply needs, without a direct threat of cancellation of rights if they don't put them to use within 10 years.

However, the new wording may also make it more difficult for and less likely that the Commission will aggressively pursue cancellation of unused surface water rights. As water supplies in the State become increasingly scarce, determination of excess water supplies and allocation of water rights to those supplies will become an even more important issue. State government has an obligation to see that its surface water is efficiently allocated to those uses that need it, and that excess supplies are used beneficially and not held for an unreasonable period of time.

**Actions Since Adoption of the 1990 Water Plan**

- Texas House Bill 529 amended the Texas Water Code provisions for cancellation for nonuse of water rights permits, certified filings, and certificates of adjudication. Holders of water rights not used at all during a ten-year period would be able to show diligence toward using the water, and intent to use in the future, thus potentially avoiding total cancellation of the right.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Revise the State's surface water rights review and cancellation process to ensure that unused and unneeded water rights are made available for use. | | ✓ | |
| The Legislature should consider clarifying conditions for temporary water supply contract transactions to respond to concerns regarding water rates to be charged and to ensure that the water provider maintains the legal right to renew service or discontinue service at the conclusion of the stated water supply contract period. | | | ✓ |
| TWC should evaluate current law and its rules concerning cancellation of water rights for nonuse to determine possible incentives for water rights holders to conserve water. | | ✓ | |
| Continue and further support TWC program to establish water divisions statewide and appoint watermasters to administer each division. | | ✓ | |

**Relevant 1990 Water Plan Issues and New Issues**

- Although House Bill 529 and the proposed new TWC conservation rules address much of the concern, there is still the potential for the cancellation process to cause users to waste water, rather than have their right subject to cancellation by the TWC due to nonuse.

- On the other hand, Texas' water rights cancellation statutory provisions are relatively lenient in comparison with rules in other states.

- Although forfeiture and abandonment proceedings have been infrequent, pressure for cancellation of unused rights will increase as water scarcity and competition for water rights become more acute. At the same time, the potential for water rights cancellation is an incentive to engage in market transactions rather than potentially lose the right to the surface water with no compensation.

- State programs to monitor use, protect existing rights, and implement efficient transfers and marketing mechanisms need to be enhanced (see also recommendations of Section 3.1.8).

**Recommendations for Amendment of the Water Plan**

★ No new recommendations are proposed beyond those in the 1990 Plan.

### *3.1.8 Water Importation*

In some areas of Texas, water supplies are limited to finite and exhaustible quantities of ground water. In a few other areas, locally-available surface water supplies may be inadequate to meet long-term water supply needs. Importation of water from other states has been considered as an option for Texas several times in the past. The 1968 Texas Water Plan made provisions for the importation of large quantities (an estimated 12 to 13 million acre-feet of water per year by 2020) to meet Texas' water needs, primarily for irrigation use in the High Plains.

The 1984 Texas Water Plan also considered interstate importation as an alternative. However, by 1984, studies had shown that major *long-distance* interstate diversions of water would generally be prohibitively expensive and politically difficult. Under present circumstances, major interstate importation of water, distinguished from local efforts to import ground water and interstate diversion of surface water within a shared or nearby river basin through existing or future interstate compact agreements, would not be necessary and would likely be prohibitively expensive.

In a related issue, the 69th Texas Legislature created the Multi-State Water Resources Planning Commission to study water importation questions and options and to work with other states in an attempt to identify available water supplies and cost-effective import supply alternatives. The Commission was never funded by the Legislature and has been inactive.

**Actions Since Adoption of the 1990 Water Plan**

- Oklahoma has recently passed legislation that would allow importation of water supplies from the Sardis Reservoir in southeastern Oklahoma to provide for future water needs in the northeastern portion of the Dallas metroplex. Engineering and economic studies are commencing to assess its ultimate feasibility.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| TWDB should be legislatively assigned the responsibilities of the Multi-State Water Resources Planning Commission. | | | ✓ |
| As stated under Transfers and Marketing, the Texas Legislature should consider removing the requirement that only surface water in excess of the 50-year water in-basin supply of the originating basin may be considered for interbasin water transfers. | ✓ | | |

**Relevant 1990 Water Plan Issues and New Issues**

- The 1990 State Water Plan noted that long-range interstate importation projects should be considered in long-term water supply plans only in the context of evaluation of all possible

alternatives. Since preparation of the 1990 State Water Plan, cooperative interstate efforts, state legislative changes in Oklahoma, and a better recognition that agreements could be devised where all participants realize gains, have improved feasibility of this alternative. Where opportunities for mutually beneficial agreements occur, water importation should be considered as a regional water supply alternative.

- Intrastate/interbasin transfers and marketing programs need to be further evaluated and promoted. Also, any project proposing interbasin transfers should include adequate consideration of the needs of that basin without restrictions which preclude such transfers at the outset before evaluations can be made. Such transfers can, in some cases, help alleviate the need for new expensive surface water reservoir projects in certain areas of need.

**Recommendations for Amendment of the Water Plan**

- ★ Appropriate policy is needed for environmental resources protection where interbasin transfers are proposed, especially to examine the effects of the proposed transfer on downstream environmental water needs in the originating basin and the potential introduction of nuisance exotic species into the receiving basin.

## *3.2 SURFACE WATER SUPPLY SOURCE MANAGEMENT AND PROTECTION*

### *3.2.1 Surface Water Supply Source Management and Protection*

In the majority of State streams and reservoirs, Texas has done a good job of protecting existing surface water from point sources (those emanating from a discrete discharge location such as a sewer pipe) of pollution. State and local governments have historically been less effective in controlling nonpoint sources (originating from diffuse rainfall runoff) of pollution, limiting adverse development, or otherwise regulating land use practices which contribute to water quality degradation and flooding. Several programs at the Federal, State, and local levels are being implemented to determine types and sources of water quality degradation, assess risks, and target remedial actions to the most impacted areas.

Approaches being used to protect water quality in several areas of the country include formal designation of potential water supply sources, imposition of development restrictions, managing reservoir watersheds and implementation of both structural (physical) and non-structural (management) measures. These control measures are also effective in providing flood protection which is itself a means for protecting water quality. Structural controls include facilities to control or treat nonpoint sources of pollution, stormwater discharges, and more conventional wastewater discharges. Non-structural methods include waste minimization programs, recycling, Best Management Practice(s) (BMPs) to minimize pollution impacts, land development restrictions in certain areas, and acquisition of critical sites such as wetlands, natural open spaces, stream and other riparian buffer corridors, and aquifer recharge areas. More comprehensive approaches such as watershed or basin-wide planning and management are required to ensure that safe, dependable water supplies will be available for a variety of uses by all Texans at a reasonable cost.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Require watershed management plans to protect the quality of sources. | | ✓ | |
| Provide a TWDB report to the Legislature on the potential to implement a reservoir site protection program. | | | ✓ |
| Revise the State's water quality standards program to designate potential surface water reservoir sites as public water supply. | | | ✓ |
| Expand TWDB financing programs to support/encourage use of low-intensity structural NPS measures and non-structural alternatives to protect water quality. The Texas Legislature should consider funding cooperative NPS projects involving more than one State agency and for projects on State-owned lands. | | | ✓ |

**Recommendations for Amendment of the Water Plan**

★ Completion of a TWDB report to the Legislature on the potential to implement a reservoir site protection program, as recommended in the 1990 Texas Water Plan is encouraged.

**The Clean Rivers (SB 818) Program.** In 1991, the 72nd Texas Legislature passed Senate Bill 818 creating the Clean Rivers Program which authorizes a regional assessment of water quality by watershed and river basin. A new section 26.0135 was added to the Texas Water Code for the purpose of assessing historical, existing, and projected water quality conditions in order to maintain and improve the quality of the State's water resources. Regional water quality assessments are performed by river authorities and designated local governments or the Texas Water Commission in order to provide sufficient information to take corrective action to protect and maintain water quality under other regulatory authority of the Commission. The act intends to focus on water quality problem areas; to provide for a more comprehensive, holistic method of assessment and action; and to avoid duplication of effort.

**Actions Since Adoption of the 1990 Water Plan**

- The regional water quality assessment reports are due every two years to the Texas Water Commission, the Texas Parks and Wildlife Department, and the Governor's Office. Twenty- six discrete elements are to be addressed in the assessments, which may be organized for discussion purposes into the following major categories:

  (1) Municipal and industrial wastewater discharges, including effluent parameters and daily volume.
  (2) Nonpoint source pollution identification.
  (3) Nutrient loading estimates.
  (4) Occurrence of toxic materials and status of "superfund" sites.

(5) Aquatic life biological health indices.
(6) Public education programs/citizen involvement, including citizen monitoring activities.
(7) Pollution prevention activities, both locally and regionally.
(8) Enforcement or other regulatory actions in the watershed.
(9) Corrective actions necessary to maintain or improve water quality to be taken at the State or local level.
(10) Population, water uses, and land use projections.
(11) Solid waste facilities and disposal.
(12) Abandoned or problem wells, septic tanks, and petroleum storage tanks.

- Initial regional water quality assessments will use existing data and studies. Future assessments should respond to recommendations from existing studies, establish additional data collection efforts needed, and initiate new investigations in response to problems identified.

- The Commission has stressed that the Senate Bill 818 program is flexible and will be targeted to the unique needs identified in each river basin. The future focus of the program will be on pollution prevention, citizen involvement, local solutions to problems, and overall water quality improvements. It should be emphasized that the Commission continues to conduct other statewide water quality management programs concurrently: the Continuing Planning Process, the State Water Quality Management Plan, the Clean Lakes Program, the Nonpoint Source Pollution Control Program, the Total Maximum Daily Load (TMDL) Program, the Statewide Ambient Monitoring Program, etc..

**Relevant 1990 Water Plan Issues and New Issues**

▸ The S.B. 818 program is new and is not specifically identified as such in the Water Plan. However, the Plan does recommend development of watershed management plans to protect the quality of surface water sources. The Plan supports the establishment of water divisions statewide and the appointment of watermasters to administer surface water rights in each division through local administration. The intent of the latter recommendation was directed primarily at water uses but the Senate Bill 818 program includes both water quality and uses and is more comprehensive. The current program should fulfill the recommendations in the Plan.

**Recommendations for Amendment of the Water Plan**

★ No new recommendations are proposed beyond those in the 1990 Plan.

**Water Quality Standards**. Section 303(c) of the Federal 1972 Clean Water Act (CWA) requires the triennial review of water quality standards by the Governor or the state water pollution control agency. In Texas, this review has always been conducted by the water pollution control agency, which is, by statute, the Texas Water Commission or its successor agency, the Texas Natural Resources Conservation Commission. Since the 1990 Water Plan, the Texas Water Commission has reviewed and issued new Texas Surface Water Quality Standards (WQS), effective July 10, 1991. The new standards will provide for improved water quality that will

benefit both man and the environment. While substantial water quality benefits are likely to be realized, these new standards will also increase infrastructure costs to financially strained local governments at a time when the extent of the cost of the prior WQS revision (1989) has not yet been fully realized.

To evaluate compliance with stringent stream standards, additional data will be necessary to address conventional pollutants and emerging water quality concerns. The regional assessments of water quality, prepared as part of the Clean Rivers Program, will identify data needs. Also, refer to the key policy recommendations on "Data Collection, Research, and Information Dissemination" on page *x* .

**Actions Since Adoption of the 1990 Water Plan**

- The Texas Water Commission adopted the 1991 WQS, including 61 new numerical human health criteria for potentially toxic substances and a presumed aquatic life use of "high" for all currently unclassified waters, with subsequent approval by the Environmental Protection Agency (EPA) on September 24, 1991.

- Senate Bill 1081, dated December 31, 1991, as proposed by Senator Baucus, et al., is a revised Federal bill that requires all of the nation's waters to have the mandatory use designation of "fishable, swimmable". No lesser uses for the nation's waters would be allowed, except on a temporary basis. Permittees would be given three years to comply with the new limitations.

**Relevant 1990 Water Plan Issues and New Issues**

- ▸ Implementation of the nation's environmental programs, including the Clean Water Act, has evolved into a regulatory framework whereby the Congress establishes more and more stringent regulations for the state and local governments to implement without providing the necessary funding to accomplish the specified objectives.

- ▸ The Texas Water Commission, in response to EPA policy and guidance, has established WQS that are some of the most stringent in the nation. Little detailed analysis has been performed to assess the economic impact of their implementation. In its rule-making summary for the WQS as originally proposed, the Commission indicated that the public benefit, as a result of enforcing and administering the revised WQS, would be improvements in: the regulation of permitted wastewater discharges, the quality of surface water resources of the State, the protection of public drinking water supplies and aquatic life, and the compliance with provisions of the Texas Water Code and the regulations of the Texas Water Commission. Compliance with the higher standards will, of course, place noticeable additional costs upon many regional and local governments and consumers.

**Recommendations for Amendment of the Water Plan**

- ★ No new recommendations are proposed beyond those in the 1990 Plan.

**Nonpoint Source Pollution Control.** Although Section 208 of the 1972 Clean Water Act (CWA) required water quality management plans to set forth procedures and methods to control "to the extent feasible," pollution from nonpoint source categories, little progress was made in the implementation of management practices until the passage of the 1987 Amendments to the Clean Water Act. Section 319 of the 1987 Amendments established a national demonstration program for the implementation of Best Management Practice(s) with projects identified and prioritized through a two-step procedure: (1) identification and severity of impact noted in a nonpoint source assessment report and, (2) the subsequent selection of appropriate Best Management Practice(s) for project implementation and their identification in the nonpoint source management report. Even though Congress has recently begun to appropriate significant amounts of money to this program, appropriations to Section 319 are not projected to be sufficient to control nonpoint sources nation-wide, even after the statutory removal of urban stormwater as a nonpoint source category by the 1987 Amendments.

### Actions Since Adoption of the 1990 Water Plan

- Congressional passage of the 1990 Reauthorization of the Coastal Zone Management Act makes control of nonpoint sources mandatory within the coastal zone, when required by a Federally-approved Coastal Zone Management Plan.

- Congressional passage of the 1990 Farm Bill provides funding for wetlands and other environmental conservation and water quality programs to reduce soil loss and the improper use of agricultural chemicals.

- Senate Majority Staff Amendment to Senate Bill 1081, dated December 31, 1991, proposes in Section 122 of the draft bill to make nonpoint source controls mandatory for waters specified pursuant to required EPA guidelines, (which are to be developed later). A proposed new subsection 319(p) also indicates that nothing in Section 319 shall be construed "to supersede, abrogate or otherwise impair the rights of any state to allocate quantities of water within the State."

- TWDB, through the Research and Planning Fund, is funding research projects to evaluate the effects of nonpoint source pollution on aquatic ecosystems and to measure the actual efficiencies of Best Management Practice(s) for the protection of ground and surface water supplies.

### Relevant 1990 Water Plan Issues and New Issues

- The 1990 Water Plan called for an increased emphasis on the characterization of sedimentation in Texas reservoirs. It also recommended studies to determine to what extent sediment loadings affect the estuarine and coastal ecology.

- The 1990 Water Plan encouraged greater conservation of the water used by irrigated agriculture, which could subsequently reduce the amount of agricultural return flow and pollutant loading to Texas watersheds.

- Funding for the implementation of nonpoint source controls is an eligible expense under the State Revolving Fund, but the amount of the capitalization grants proposed and appropriated through Title VI of the CWA do not consider the expenditures necessary to achieve meaningful reductions in nonpoint source pollution loadings.

- Nonpoint source pollution controls and Best Management Practice(s) (BMPs) vary greatly in their effectiveness, and are often not very efficient in nutrient (particularly nitrogen) removal capability. However, some research (Chesapeake Bay Program) suggests that nutrient removal rates of less than 80% are not effective in restoring water quality or maintaining aquatic life uses. This suggests that only those BMPs which reduce nitrogen input in excess of 80% would have positive effects on water quality. While research on Chesapeake Bay is not directly transferable to conditions in Texas, future nutrient research proposed by the Board on estuaries such as Galveston Bay may enable more informed decisions on nonpoint source pollution controls to be made.

**Recommendations for Amendment of the Water Plan**

- No new recommendations are proposed beyond those in the 1990 Plan.

**Stormwater Management.** Although the 1972 Clean Water Act (CWA) prohibited the discharge of pollutants to the Nation's waters unless authorized by a National Pollutant Discharge Elimination System (NPDES) permit, efforts to regulate stormwater discharges have historically been limited to the control of certain industrial discharges. The CWA amendments of 1987, however, directed the Environmental Protection Agency (EPA) to establish a phased NPDES program for stormwater discharges from both municipal and industrial sources. Capitalization of the CWA Title VI State Revolving Fund (SRF) was estimated in 1987 to require $18 billion in Federal funds nationwide to construct eligible wastewater treatment facilities, but that estimate did not include the infrastructure needs of municipalities or other local governmental units to control pollution from stormwater discharges.

**Actions Since Adoption of the 1990 Water Plan**

- EPA promulgated final stormwater permit application requirements on November 16, 1990. Deadlines were established for Part 1 and Part 2 applications for large (250,000 or greater population) and medium (100,000 to 250,000 population) municipalities. Deadlines were also established for the industrial individual permit applications and for Parts 1 and 2 of the industrial group permit applications. EPA also proposed an Industrial General Permit Notice of Intent on August 16, 1991 for Texas and the 11 other states without NPDES delegation.

**Relevant 1990 Water Plan Issues and New Issues**

- Although the construction of storm water control and treatment facilities is an eligible expense under the SRF, the capitalization grants proposed and appropriated by Congress do not consider the capital expenditures that may be required for municipalities to implement a successful stormwater control program.

- Pending completion and tabulation of the fiscal analyses required in Part 2 of the municipal permit applications, no valid estimate of capital needs can be developed for SRF program management. (Part 2 permit applications require details on "legal authority, source identification, discharge characterization data, proposed management programs, estimated reduction in loadings of pollutants, and fiscal analysis of necessary capital and operation and maintenance expenditures.")

- EPA has proposed the inclusion of stormwater needs in the Category VI totals of the 1992 Needs Survey, even though limited information will be available to estimate the actual cost of the necessary control and treatment facilities.

**Recommendations for Amendment of the Water Plan**

★ No new recommendations are proposed beyond those in the 1990 Plan.

### *3.2.2 Reservoir Operations and Capacity Maintenance*

Texas currently has 188 major reservoirs that provide a substantial percentage of the surface water used in the State. However, many of these impoundments have roughly estimated storage capacities and/or have experienced accelerated sedimentation leading to unforseen loss of storage capacity.

Also, successive reservoirs located on a river system, as well as individual reservoirs, may not be used to their full operational potential to supply water. There are even potential opportunities to provide for system operations of reservoirs among differing river basins. Because developing water sources is very expensive, the capability of existing projects to continue to supply the maximum amount of water must be protected and enhanced.

**Actions Since Adoption of the 1990 Water Plan**

- The Board's new Hydrographic Survey Program, based on satellite surveying techniques, is providing research services to political subdivisions of the State, including: accurate determinations of bathymetry, reservoir storage volumes, water surface areas, rate of loss of water storage due to sedimentation, and other specialty studies. These services will help improve reservoir operations due to better understanding of storage capacity at different lake elevations, more knowledgeable sales contracting of existing supplies, and for considering potential reservoir reallocation decisions. Furthermore, the capacity and sedimentation information collected will be used to update the Board's water supply forecasts. User charges to eligible political subdivisions desiring these hydrographic survey services support the costs of the new program.

- The Texas Water Development Board provided funding for a Texas A & M University research project to improve reservoir simulation models to account for saline water and water rights. The recently-commissioned study will focus on 12 major reservoirs in the Brazos River Basin, and will be coordinated with another chloride control study being conducted jointly in the upper basin by the Board and the Army Corps of Engineers.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Expand funding for Board program that measures sediment accumulating in existing reservoirs. Establish program to educate water planners and engineers about techniques for, and benefits of, preventing sedimentation and routing sediment through existing and planned reservoirs. | | ✓ | |
| The State's water financing programs should be expanded to clearly provide funding authority for strucutral and non-structural approaches to sediment control and the removal and beneficial use of settled material in conjunction with protecting water storage capacity in existing or future reservoirs. | | ✓ | |
| The State should support expanded Federal funding for land management programs for reducing soil erosion and resulting reservoir sedimentation. | | | ✓ |
| Review State water rights legislation to ensure TWC has adequate authority to require plans for the systematic operation of individual reservoirs and multiple reservoirs. Charge TWC with promulgating guidelines. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- Many major reservoirs in Texas have accelerated sedimentation and successive reservoirs located on a river system, as well as individual reservoirs, may not be used to their full operational potential to supply water.
- Current State policy encourages reservoirs to be locally planned, permitted and operated on an individual basis, even though implementation of systems operation procedures are estimated to increase available supplies by as much as 20 to 50 percent without new development.
- Current activities to maintain the usable capacity of existing reservoirs must be expanded.
- Impacts of reservoir releases on ground water and instream flows need to be studied.
- TWC does not have authority to provide for the comprehensive gate operation of reservoirs (i.e., over system operations), including regulation of flood releases.
- Proposed spill control operations need to consider dam safety issues.

**Recommendations for Amendment of the Water Plan**

- ★ The State should fund research aimed at improving reservoir operations and environmental assessments, both individually and as systems, to achieve maximum water supply yields and ensure availability of adequate water for environmental uses.

### 3.2.3 Dam Safety

The safety of the 6,300 dams in Texas and the security of 30 percent of the State's surface water supply are affected by many problems, increasing the demands placed on the Texas Water Commission's Dam Safety Program. These problems include poor decisions made during the design and construction process, insufficient financial resources to upgrade deficient structures, uneven regulation of floodplain development, large-scale flooding or seepage, operational mismanagement, inadequate enforcement procedures, lack of consistent information on non-Federal dams, and permit issuance for only those dams covered by the State's water rights permitting process.

**Actions Since Adoption of the 1990 Water Plan**

- Texas Senate Bill 1543, sponsored by Senator Carl Parker, addresses flood control in the Trinity River Basin. The bill provides that TWC, in conjunction with the Trinity River Authority of Texas, the U.S. Army Corps of Engineers, and other reservoir owners in the Trinity River Basin, shall develop and implement a coordinated basinwide water release program for flood routing and control. The bill also authorizes land management measures for flood protection by any county with all or part of its area in the Trinity River Basin 100-year floodplain.

- The Texas Water Commission published guidelines in September 1991 for the operation and maintenance of dams in Texas.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Establish a fee-based dam safety inspection program to fund TWC dam safety activities. | | | ✓ |
| Texas Legislature should consider requiring local governments and regional entities to adopt, under direction of TWC, watershed management plans to reduce potential dam safety and reservoir operations problems. | | ✓ | |
| Adequately fund TWC to continue/expand its educational and public awareness program to inform dam owners of their responsibilities and the general public of the risks associated with development below dams. TWC should work with owners to establish acceptable early warning programs. | | | ✓ |
| Authorize TWC to impose administrative penalties to enforce dam safety. | | | ✓ |
| Texas Legislature should ensure that local entities with substandard dam facilities have adequate authority to obtain sufficient revenue needed to participate in the TWDB low-interest flood protection loan program or the proposed new State water-related infrastructure financing program. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- As noted in the 1990 State Water Plan, quantifying costs of rehabilitating existing water-related facilities is problematic and requires expensive study. These costs can be significant with the structural and hydraulic rehabilitation of Morris Sheppard Dam (Possum Kingdom Reservoir) alone costing approximately $40 million.

**Recommendations for Amendment of the Water Plan**

★ No new recommendations are proposed beyond those in the 1990 Plan.

## 3.3 GROUND-WATER SUPPLY SOURCE MANAGEMENT AND PROTECTION

### 3.3.1 Ground-water Supply Source Management

Ground water makes up a large part of Texas' usable and potentially usable freshwater resources. Planning, management, and protection of ground-water resources is an important function of local, regional, and state governments, as well as the private sector. In general, Texas law differentiates between surface water and ground water. Surface water is considered a State property and the right to use it is controlled by the State. Conversely, ground water not flowing in underground rivers, is conceptually considered a private property and individual landowners have the right, with some limitations, to capture and use the ground water beneath their property.

As more is known about the characteristics of individual aquifers, many questions are being posed about appropriate mechanisms to adequately manage this resource. The main approach used in Texas is through underground water conservation districts with selected powers to manage and protect the resource and to set conditions on how wells are constructed and used. While these districts have certain regulatory powers, the actual right to capture and use the ground water, except where regulated by subsidence districts, is still assigned to the landowners. Some have argued that in certain areas these powers are not enough, and that Texas needs to have more organized control over the use of ground water, such as implementing a permitting system similar to that for surface water. Others, however, argue that the overriding factor is the right of capture of ground water and that the State should not infring on a perceived private property right.

**Actions Since Adoption of the 1990 Water Plan**

- Perhaps the most significant ground-water event since the adoption of the 1990 Water Plan has been precipitated by the problems of the Edwards Aquifer region. An opinion by the Attorney General of Texas interprets Section 28.011 of the Texas Water Code entitled, "Underground Water: Regulations", as not restricting the Texas Water Commission's authority to implement ground-water rules and regulations. While the Attorney General's opinion did not necessarily overturn the concept of right of capture of ground water, the Commission attempted to spur subsequent action by water-using groups in the Edwards region. A later clarification by the Attorney General indicated that the ruling alone did not give the TWC the necessary authority to regulate ground water in the State. By proposing emergency

management measures for the region in order to preclude Federal intervention in the situation, the Commission assumed authority by designating the Edwards formation an underground river and subject to regulation under Chapters 11 and 26 of the Texas Water Code. While the authority of the TWC has subsequently been limited by a District court decision, the actual control measures that would have been put into effect were never fully clear. In the Edwards' case, a formation with limited ground-water resources historically, the Commission apparently intended either to spur action by local and regional entities to adequately address existing and anticipated problems or to dictate control measures at the State level.

- A Federal lawsuit, related to enforcement of the Endangered Species Act, was filed by the Sierra Club and the Guadalupe-Blanco River Authority against the Federal government citing failure of the U.S. Fish and Wildlife Service to take action to protect endangered species threatened by reduction or cessation of springflows from the Edwards Aquifer. Lawsuit testimony was completed in November 1992 with a decision expected by the end of the year.

- Texas House Bill 1744 was enacted by the Texas Legislature which, among other changes, clarified Texas Water Code provisions to define an "active" district. This addressed part of the issue in the previous Water Plan concerning Commission authority to ensure that underground water conservation districts are instituting appropriate management programs and were actively performing the functions for which they were created.

- Proposed Federal legislation would provide for USGS to map and assess transboundary aquifers.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Fund TWDB to offer additional technical assistance to local districts to increase their capacity to gather water use information. Provide monetary assistance to districts that assist the State. Fund TWDB to increase its ground-water monitoring and data collection activities for areas not covered by a district or other appropriate entity. | | ✓ | |
| TWC should encourage Underground Water Conservation Districts (UWCDs) to submit ground-water management plans required under Chapter 52 of the Texas Water Code. | | ✓ | |
| TWC should ensure that ground-water management plans are provided to TWDB. TWDB should coordinate planning goals with appropriate agencies to ensure that needs of local areas and the State are addressed and develop more comprehensive State planning assistance programs for local districts. | | ✓ | |
| TWC, with TWDB assistance, should work with local entities to establish management goals and policies. Authorize TWDB to loan funds to local entities to implement TWC-established measures until a district is created. | | ✓ | |
| Texas Legislature should ensure that UWCDs have appropriate methods to raise sufficient revenue. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- All aquifers are not alike, and while the right of capture and relatively unlimited use doctrine in Texas works fine in many cases, there are certain types of aquifers where the use of ground water by one landowner has a direct effect on another landowner's supply. Where the rates of water level decline and pumpage of the aquifer are high, or in areas of subsidence, the extensive, unlimited use of ground water can cause problems for an entire area.

- As demands increase for limited supplies, the landowners' right to ground water has presented a number of situations where land itself or certain rights associated with the land are purchased for the purpose of using the ground water. These purchases, especially in the case of larger municipal users acquiring agricultural land rights, may substantially alter the physical and economic character of a region, such as putting irrigated acreage out of production. While the deal may be economically advantageous for the landowner, there may be deleterious effects on the surrounding area.

- Even in areas with underground water conservation districts, the data base and knowledge of particular ground-water resources is often limited. Also, because of the individual pumping rights, in some areas there is a significant lack of information about the amount of water being used and the possible effect on the aquifer.

- The Texas Water Code still contains provisions that require local elections for creation of an underground water conservation district to be final. In an area experiencing problems, such as designated critical areas, the reluctance of local residents to ratify creation of a district, or the creation of multiple districts where a single regional district would be more appropriate may present problems. The administrative implementation of critical area district formation has thus, been delayed in those areas. However, the recent opinion and clarification by the Attorney General concerning the authority of the Texas Water Commission may address part of this problem, but how the Commission will ultimately use its authority, and the ensuing final resolution of the pending litigation, coupled with the possibility of additional legislative initiatives, make the future of ground water management uncertain.

- While House Bill 1744 helped to clarify what would be considered an active district, there still may be underground water conservation districts in problem areas that either don't have the resources or are not willing to enact measures to adequately address the problems and, some have argued, the powers of the districts are still not adequate to really manage ground water sufficiently. Others argue, that if the problems are significant enough the local entities will take action, but that the measures should be a completely local concern and not regionalized or raised to the State level.

- Aquifer recharge and yield enhancement issues are discussed in "Water Supply Yield Enhancement" (Section 3.1.6).

**Recommendations for Amendment of the Water Plan**

- ★ In areas where the State has been unable to establish a district to effectively address existing or potential ground-water problems, the Legislature should consider providing the Texas Water

Commission with appropriate authority, consistent with that authority given districts in Chapter 52 of the Water Code, to work with local entities to establish necessary ground-water management measures. The Legislature should consider also allowing the Board to loan funds for this interim management program until local district financing can be established. Ground-water districts should be assisted by the Board to improve data collection programs and planning to enhance the ability to develop long-range water plans. The Legislature should consider examination and enaction of methods for streamlining and improving the Critical Area process.

### *3.3.2 Ground-water Quality Protection*

Ground-water quality can be affected by a very wide array of factors. In Texas, the main contamination sources that have been identified include:

(a) improperly completed or abandoned water wells;
(b) improperly completed or abandoned oil and gas wells and abandoned oil field waste disposal pits;
(c) improperly sited or constructed septic systems, sewage and wastewater disposal systems, and municipal collection lines;
(d) industrial wastewater impoundment sites that were in use before more stringent performance standards were enacted;
(e) leaking oil and gasoline storage tanks;
(f) waste disposal sites, including sites that were inadequately monitored and controlled in the past;
(g) agricultural practices, such as improper fertilizer or chemical application and seepage from various sources resulting in high nitrate content;
(h) contamination from naturally occurring substances or the intrusion of poor quality water into freshwater aquifers;
(i) other possible nonpoint sources of contamination, including urban stormwater runoff over recharge areas, and
(j) contamination of ground water from natural sources or intrusion of poorer quality water into freshwater aquifers may affect the largest amount of the State's usable ground-water resources.

**Actions Since Adoption of the 1990 Water Plan**

- Texas Attorney General Morales issued Opinion No. DM-54 on November 4, 1991 overturning a 1941 Attorney General's Opinion (No. O-3205-A) that had previously limited the regulation of ground water by the Texas Water Commission or its predecessor agencies. See additional discussion under Section 3.3.1, Ground-water Supply Source Management, that is specific to the issues of the Edwards formation.

- Texas Senate Bill 1103 was enacted by the Legislature creating a $10 million oil field clean-up fund. The Railroad Commission of Texas can use the fund to plug wells and clean pits and

other pollution sites that have been abandoned or for which the responsible parties have no resources to adequately clean up.

- House Bill 1744 was enacted by the Legislature which, among other things, defined "active" districts. See discussion under 3.3.1, Ground-water Supply Source Management.

- Consolidation of agency functions into the Texas Water Commission and, in September 1993, its successor agency, the Texas Natural Resources Conservation Commission. The Texas Railroad Commission retains authority over ground-water programs associated with oil and gas production.

- Regional issues, such as the City of Austin's "Save Our Springs" ordinance for protecting the quality of water feeding Barton Creek and Barton Springs, will have statewide implications related to the extent that cities and other entities can go to establish significant land development controls to protect water resources.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Implement the State's nondegradation policy. | | | ✓ |
| Continue TWDB program to provide funding to districts to obtain ground-water quality testing equipment and possibly expand by raising the amount of interest funding available to TWDB from the Agricultural Trust Fund. | | ✓ | |
| Increase field enforcement of ground-water quality protection regulations. | | ✓ | |
| Evaluate State ground-water data systems. | | ✓ | |
| Texas Legislature should consider increasing funding for the Wellhead Protection Program. | | | ✓ |
| The Ground-Water Protection Committee should review the need for more local/regional/State authority to enact comprehensive ground-water protection regulations. Texas Legislature should consider providing TWDB and TWC funding to increase efforts to identify areas needing additional protection and areas of potential future water supplies that need protection. | | ✓ | |
| Texas Legislature should consider providing funding to TWC for the DRASTIC* mapping programs and to TWDB to better incorporate this technology and information into its planning and local assistance activities. *An acronym for the seven hydrogeologic parameters that are evaluated for purposes of comparing the ground-water pollution potential of various hydrogeologic settings. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- Costs of meeting Safe Drinking Water Act standards will significantly impact cost of water supplies. Due to source quality and availability, many water suppliers will either face expensive treatment costs to reduce dissolved salts (chlorides, fluorides, sulfates, etc.) or natural radioactivity, or will face developing an expensive alternative water supply source.

- The extent of the Texas Water Commission's authority to enact controls on ground water and the final outcome of ongoing litigation in that regard will have significant implications for ground-water quality as well as ground-water use and availability.

- Much additional data concerning both the availability and quality of ground-water resources is still needed. The efforts of the TWC and the Board, as well as other agencies, to collect and analyze ground-water data needs to be well coordinated.

**Recommendations for Amendment of the Water Plan**

- ★ No new recommendations are proposed beyond those in the 1990 Plan.

## *3.4 REGIONALIZATION*

Regionalization is the process by which a municipality, special district, or private utility provides water, wastewater, solid waste, or flood protection services for itself and one or more additional entities. Normally, it involves combining service needs of several small areas into a larger one for reasons of economic benefits, improved operation and maintenance, or greater consistency in meeting water quality, drinking water, and waste management requirements and flood protection goals. Regionalization is generally pursued in areas where it appears to be the least costly alternative to traditional utility service provision and where certain institutional obstacles can be overcome. It may include combining physical facilities, centralizing management operations, or both. In all cases, cost-effective provision of services with the least impact on the environment should be supported.

**Actions Since Adoption of the 1990 Water Plan**

- TWC has adopted rules concerning community development of regional wastewater plans and implementation of those plans through the its permitting process. The rules state that the TWC will consider regional plans approved by designated planning agencies or the TWC and adopted by a municipality for the area within the city limits and extraterritorial jurisdiction (ETJ) when evaluating a domestic wastewater permit application. When considering applications for new, amended, or renewed permits the TWC will determine whether the serviced area must connect to a regional plant. Entities with approved regional plans will be notified by TWC of any applications for a permit to discharge within the city and ETJ.

- In at least one instance involving a wholesale wastewater rate case between municipalities, the Commission took the position that its appellate rate jurisdiction superseded disputed utility service contracts between the affected parties. The result of this decision was to overturn

contract cost provisions which TWC found unacceptable, but the greater impact of the decision is the precedent that could possibly be set by the Commission's action.

- Interest in privatization and joint public/private cooperation in the development of infrastructure and other public facilities is increasing.

- TWDB is increasing emphasis on regional management systems in which multiple facilities are built to serve separate areas, with one entity retaining central management authority.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Texas Legislature should consider enaction of a formal policy which preferentially favors regional, rather than individual, system development. | | ✓ | |
| Texas Legislature should consider creation of a program within TWDB and TWC to study, determine, and designate water supply and wastewater service areas where regionalization may be preferable. | | | ✓ |
| State agencies should cooperate to: (a) identify critical utility service areas characterized by numerous small or inadequate systems or water problems that threaten water quality or reliability of service, (b) designate a regional service provider, and (c) require that all proposed and existing facilities, when economically feasible and practical, participate in the regional system. | | ✓ | |
| Texas Legislature should consider giving all regional utility authorities the ability to develop and manage regional utility systems where this would not replicate existing regional authorities with similar powers and service areas. | | | ✓ |
| The Legislature should consider authorizing the TWC to approve the development of new utility facilities being created only after the TWC has determined that the creation of a regional system or obtaining services from an existing regional or adjacent facility where uncommitted capacity is available or can be provided through facility expansion is technically or economically infeasible or impractical. | | | ✓ |
| The Legislature should consider ensuring that statutes authorizing district creation by TWC include the concept of regional management or operating systems as well as regional facilities. | | | ✓ |
| The Texas Water Code currently authorizes the TWC to designate regional wastewater service providers. The description of regional and areawide waste collection, treatment, and disposal facilities included in Section 26.081 of the Texas Water Code should, however, be expanded to incorporate the concept of regional or areawide management or operating systems. | | | ✓ |
| The Legislature should consider a statutory procedure for designating regional water supply providers comparable to the designation of regional wastewater service providers currently authorized under the Water Code. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- The two most probable reasons for not regionalizing, where economically feasible, are fear of losing local control, and the absence of strong financial incentives (in some instances, the lack of recognition of what financial incentives are available). Fear of losing operational control and rate setting over local utilities may be the most common. Distrust and competition between neighboring municipalities or special districts often prevent utilization of regional facilities, even when cost savings appear likely.

- Inadequate population densities, distances between populated areas, and environmental concerns are additional factors which may inhibit formation of regional systems. The pollutant load from a large regional wastewater facility can sometimes cause dissolved oxygen depletion in the receiving stream, which could otherwise assimilate the same load if it was dispersed among several discharge locations. Ensuring the optimal size of the facility, while considering the physical nature of the service area and the environment receiving treated effluent, is essential in designing a regional system.

- Other obstacles to regionalization include different growth rates between entities, lack of awareness of benefits, unequal financial capabilities between entities and inadequate development density to justify regional implementation. Also, lack of a good statutory definition of regionalization and lack of a strong mandate to require regionalization often preclude its usage. For these reasons, it appears that a unified State program to encourage regionalization and assist in financing could be successful. In fact, providing attractive financial incentives is probably the key to widespread usage of regional utilities.

- The Texas Water Development Board has funded numerous regional studies for water and wastewater services, as well as others relating to water quality. Several of these studies have led to planning or construction of regional facilities in the study areas. Examples of such facilities and implementation status include:

  Lake Bosque Regional Water Supply Plan. A permit for reservoir construction has been issued by TWC; Corps of Engineers Section 404 permits have been applied for. Construction of the regional water supply reservoir could begin in 1993 or 1994.

  Regional Water Supply and Wastewater Plan for Denton County. The Legislature created the Upper Trinity Regional Water District, which is in the process of applying for a TWDB loan of $50 million for a regional water system. Wastewater system plans remain on hold.

  Regional Water Supply Plan for Hopkins County/City of Sulphur Springs. Construction of Cooper Reservoir with Corps of Engineers' funds has been completed.

  Regional Wastewater Plan for the Cities of Gatesville and Fort Gates. Resulted in the construction of a new centralized wastewater treatment plant.

  Regional Wastewater Plan for the City of Houston ETJ. City Planning Commission and Council have approved a regionalization ordinance for wastewater treatment

plants. The report is used as a long-range planning tool. All new development needing wastewater discharge permits must comply with the ordinance or obtain a variance.

Regional Water Supply and Wastewater Plan for Hidalgo County. As a result of this study, Hidalgo County has applied for and received Board funding of $4.55 million for water and wastewater improvements to colonias. Construction has begun on one project, the TWDB has committed to fund another project, and two projects are engaged in preliminary engineering.

Regional Water Supply and Wastewater Plan for Maverick County. The study identified wastewater needs for colonias adjacent to Eagle Pass. An $11.5 million Board-financed wastewater facility is under construction.

**Recommendations for Amendment of the Water Plan**

- ★ The Board should continue to pursue the construction of much-needed water and wastewater infrastructure in the State's economically distressed communities, utilizing regional systems when available, and in the most cost-effective manner possible.

- ★ The TWC and TWDB should ensure that regionalization takes full advantage of opportunities for conservation, reuse, leak detection and other measures to ensure the efficient use of water.

## *3.5 BALANCING WATER RESOURCES DEVELOPMENT WITH ENVIRONMENTAL AND LAND MANAGEMENT CONCERNS*

### *3.5.1 Environmental Uses of Water*

Major Federal environmental laws enacted in the 1970s and changes made by the Texas Legislature to the Texas Water Code in 1985 give greater emphasis to important environmental aspects of water resources decision-making, particularly freshwater inflows to bays and estuaries and flow maintenance needs for instream water uses, water quality, and fish and wildlife habitats. Furthermore, Federal and State laws have contributed substantially to a more comprehensive and coordinated management of the State's water resources. These laws have slowed the degradation and improved the condition of aquatic and terrestrial biological resources dependent on wetlands, streams, lakes, bays, and estuaries. However, competition between environmental and non-environmental water uses will remain pervasive and must be given serious consideration when selecting alternatives to best meet the State's projected water needs.

**Actions Since Adoption of the 1990 Water Plan**

- A task force was established in June, 1992, at the Second Water and Wildlife Conference to complete work needed to determine the amount of inflows needed by Texas bays and estuaries.

- Another task force, also initiated at the Second Water and Wildlife Conference, was established to start an interagency effort to address instream flow requirements.

- Texas Senate Bill 1053 (coastal management bill) includes provisions for erosion planning and erosion control projects, enforcement of Federal floodplain building standards, dune protection, coastal management planning and consistency, authorizes development of a coastal management plan, establishes the Coastal Coordination Council (CCC), and directs the CCC to adopt into its rules the goals and policies of the coastal management plan.

- Texas Senate Bill 1054 (wetlands bill) provides a legislative policy directive, but no new regulatory authority, to the Parks and Wildlife Commission and School Land Board to adopt a policy of "no net loss" of wetlands on State submerged lands in the coastal area. The bill provides definitions of wetlands for the State and provides for a State-Owned Wetlands Conservation Plan, which is currently under development.

- The proposed Nueces Bay Demonstration Project will demonstrate the beneficial use of treated wastewater discharges to supplement freshwater inflows to the estuary and enhance wetland productivity in the Nueces River delta and estuary. Funding for this proposal has not yet been obtained.

- The "Texas Method" for determining preliminary instream flow needs of fish and wildlife was developed for planning purposes where a reconnaissance-level assessment of numerous potential reservoir sites must be performed. This screening methodology was published in the October 1991 Rivers journal.

- The Macrohabitat Assessment Technique (MAT), also developed by the Texas Water Development Board, is being used by the Board in its planning determination of instream flow needs at the potential Cuero, Lindenau, Goliad, and Cibolo reservoir sites in cooperation with the U.S. Army Corps of Engineers' (Corps) Fort Worth District. The Corps' Section 22 Planning Assistance to States Program was used to fund these studies. The Board is developing three modules for use with the MAT: a hydrodynamic module, based on the finite element surface water modeling system two-dimensional model (FESWMS-2DH); a habitat assessment model, for evaluation of a stream's habitat structure; and a water quality module, which emphasizes the importance of dissolved oxygen and downstream temperature effects.

- The Texas Water Development Board, in cooperation with the Corps' Waterway Experiment Station, is developing frame and cable electroshocking equipment and field application techniques for determining fish associations to riverine habitats that can be quantified and used in instream flow assessments.

- The Texas Water Development Board and the Texas Parks and Wildlife Department have jointly published a final report entitled Freshwater Inflows to Texas Bays and Estuaries: Ecological Relationships and Methods for Determination of Needs.

- A report, published this year by the Texas Water Resources Institute, Sediment Transport in the Lower Guadalupe and San Antonio Rivers, describes the University of Texas at Austin's research to determine correlations between sediment transport and river flows and to measure the amount and characteristics of sediment loads entering a Texas bay.

- The Texas Parks and Wildlife Department completed Texas Water Development Board-supported contract study reports including, A Natural Resource Survey for Proposed Reservoir Sites and Selected Stream Segments in Texas, A Vegetation Inventory and Habitat Quality Assessment for the Proposed Cuero and Lindenau Reservoir Sites, An Aquatic Biological Inventory of the Proposed Lindenau Reservoir Site, and Habitat Characteristics and Feeding Ecology of Cagles Map Turtle (Graptemys caglei) Within the Proposed Cuero and Lindenau Reservoir Sites in order to provide better information on rivers and streams to assist in managing current water resources and planning for future water development.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Initial resource inventories and assessments for long-range water planning purposes should be conducted by TWDB in conjunction with TWC and TPWD for all reservoir sites recommended in the Texas Water Plan. | | ✓ | |
| Encourage TWDB, TWC, and TPWD to develop a common analytical methodology to evaluate the water requirements of environmental resources. | | | ✓ |
| TWC and Corps should establish a parallel time schedule for project permit applications. | | | ✓ |
| TWDB should maintain a bay and estuary program. | ✓ | | |

**Relevant 1990 Water Plan Issues and New Issues**

- Competition between environmental and human water uses remains pervasive and must be given serious consideration when selecting alternatives to best meet the State's projected water needs.

- Water development and use, especially surface water development, can change stream flow characteristics by storing flood and other stream flows in reservoirs for release and/or diversion.

- Conflicts between land uses and reservation of land resources for potential reservoir projects and preservation of environmentally sensitive sites limit the water planning options available for consideration.

- Determinations are needed of the extent and suitability of fish and wildlife habitat and associated water releases necessary to support riparian ecosystems and the living organisms dependent upon them including migratory waterfowl, threatened and endangered species, and viable aquatic communities and coastal environments that support numerous species including abundant populations of fish and shellfish.

- There is a lack of sufficient data on environmental resources to fully support water resource management and permit decisions in many cases.

- Disagreement exists over the appropriate analytical methods to use in evaluating potential or realized impacts to environmental resources.

- Conflicts arise in the legal responsibilities and missions of different Federal and State agencies.

- Lack of clear agreement exists on the use and acceptability of the different types and amounts of mitigation measures that are available to offset project impacts. Likewise, different evaluation methods used to determine mitigation requirements creates the potential for implementation conflicts. One type of mitigative action, altering project plans, involves changes in design specifications, project operations, or project locations to reduce or eliminate harmful impacts. Another includes the acquisition of compensatory lands (fee title), as well as the potential for coordinated use of mitigation (land and water) banks to achieve the same purposes more effectively. It is also possible to conceive of impounded water being released downstream to enhance fish and wildlife habitats, and that use could be termed mitigation and be a part of mitigation banking.

- Duplication or differences in State and Federal permitting procedures, scheduling, and requirements exist. Obtaining State water rights permits and Section 401 water quality certification, and Federal Section 404 permits often involves similar studies, conducted at different times, and may produce different and inconsistent findings and permit requirements.

**Recommendations for Amendment of the Water Plan**

- ★ Water determined necessary to maintain healthy aquatic ecosystems (instream flows, overbanking flows, inflows to bays and estuaries, etc.) and other environmental uses should be reserved by the State to meet those needs. Where other needs have priority, every effort should be made to mitigate impacts.

- ★ State agencies should consider sensitive environmental or imperiled communities, including wetlands, bottomland hardwood forests, and threatened and endangered species, during alternative site selection assessments of water resource projects.

- ★ The Board, Texas Parks and Wildlife Department, and Texas Water Commission should work together to expeditiously apply new State methodologies to each principal bay and estuary for the purposes of determining environmental needs for freshwater inflows. In addition, the agencies should also work cooperatively to develop and apply appropriate methodologies to determine environmental needs for instream flows with priority given to river segments that potentially will be affected by future water development projects identified in the Water Plan. The State should develop the most effective methodologies possible to evaluate the water requirements of aquatic communities in Texas.

- ★ The TPWD should cooperate with other natural resource agencies in the collection and analysis of environmental (physical, chemical, biological, and socioeconomic) data necessary to protect and manage our state's valuable fish and wildlife resources. The TPWD should also

serve as the lead agency on recommendations for maintenance of the ecological health of fish and wildlife populations.

- ⋆ The feasibility of using water stored and released from reservoir projects as one aspect of mitigation banking should be examined. Water releases above levels stipulated by permit conditions that enhance the instream flows for fish and wildlife, riparian wetlands, marshes, and estuaries are environmental benefits that potentially could be used for mitigation banking. Credits could be based on increases in fishery productivity or units of habitat and water quality improvement above those normally observed in the stream. Such credits should only be used to provide for in-kind mitigation where the mitigative action supplies a new or enhanced resource similar to that which was lost.

- ⋆ TWDB should coordinate with State and Federal agencies developing mitigation banking agreements to ensure that specific mitigation measures for water-related infrastructure are incorporated into these agreements.

- ★ Applicable State agencies should review water-rights permit procedures as they affect environmental needs for water.

- ★ Texas water managers and regulators should plan and operate surface water development projects to consider fish and wildlife needs within and downstream of impoundments, and include environmental uses of water among the designated project purposes.

- ★ Examine comprehensive watershed management or other regional alternatives as a mechanism for environmental resource management. For example, consider what role the Clean Rivers (SB 818) program or comprehensive basin management programs might play.

- ★ State and local governments should develop and implement wastewater reclamation technology for beneficial reuse, including environmental purposes.

- ★ State agencies should adopt consistent methodologies for evaluating and interpreting environmental resource data.

- ★ Provide adequate funding to TWDB, TPWD, and TWC to facilitate collecting and interpreting environmental resource data.

Some of these recommendations concerning environmental uses of water are also applicable to "Environmental Data Collection and Research" (Section 3.7.2).

### *3.5.2 Recreational Uses of Water*

Recreation, aesthetics, and heritage use proposals for free-flowing rivers may be in direct conflict with other potential uses, such as the development of surface water supply reservoirs or the real property rights of private landowners.

### Actions Since Adoption of the 1990 Water Plan

- Texas Senate Bill 1205, introduced by Senator Barrientos, would have provided for creation and administration of the Texas Protected Rivers System. However, the bill did not pass.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| In conjunction with initiation of the statewide rivers assessment proposed in the 1990 Texas Outdoor Recreation Plan (TORP), a State interagency committee should be created to identify potential conflicts and pursue agreements on the use of free-flowing riverine resources for recreational, aesthetic, and heritage purposes. An interagency report on the potential to create a State river protection system should be prepared as a legislative information document prior to January 1993. | | | ✓ |
| TWDB and TPWD should incorporate appropriate water-related outdoor recreation recommendations into the Water Plan. | | | ✓ |
| TWDB should encourage the involvement of State and Federal agencies with water-related recreation expertise in the preparation of recreation plans developed for reservoir projects that will be constructed with State financial assistance. | | | ✓ |

### Relevant 1990 Water Plan Issues and New Issues

- ▸ Various State agencies have been considering the potential for designation of selected segments of free-flowing streams for recreational, aesthetic, and heritage purposes, including such associated issues as balancing competing uses in a protected segment, securing Federal concurrence with a protected river status designation, defining the boundaries to be protected for each segment, and determining the participants in the these processes are be examined.

- ▸ Private property adjacent to free-flowing riverine resources is used without authorization by water-based recreationalists.

### Recommendations for Amendment of the Water Plan

- ★ TPWD and GLO should coordinate with the DOT and county officials to facilitate access to public streams at highway and road crossings. Effort should be made to promote the responsible use of the resource to reduce conflicts between landowners and users of the resource.

- ★ The TWC should give adequate consideration to stream navigation, especially recreational navigation, in the permitting of structures in State waterways.

### 3.5.3 Land Management

Existing and expanding human land uses create the need for water projects and influence the amount of useful water supply. Land use patterns can affect the amount of usable water supply through point and nonpoint source pollution loadings and development encroachment on potential reservoir sites. Deliberate actions that could be implemented by the State and local interests to reduce this prospect could include zoning, land use and watershed water quality controls, advance acquisition of reservoir sites, and advance mitigation of losses.

**Actions Since Adoption of the 1990 Water Plan**

Also refer to the "Environmental Uses of Water" (Section 3.5.1) and the "Surface Water Supply Source Management and Protection" (Section 3.2.1).

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| A State program should be created to identify and catalog potential reservoir sites identified in the Texas Water Plan as needed within the next 50 years. | | | ✓ |
| A formal program to preserve the integrity of each site determined to be preliminarily feasible as a reservoir site, following consideration of alternative sites, should be created and implemented. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- Existing and expanding human land uses can create the need for new water projects and influence the amount of useful water supply for man and the environment, while land use patterns can affect the amount of usable water supply through point and nonpoint source pollution loadings (especially industrial discharges and erosion) and development encroachment on potential reservoir sites.

- Potential reservoir locations may be unusable or unaffordable at the time reservoir development is needed.

- The lack of adequate engineering, socioeconomic, and environmental information required to assess existing or prospective conflicting use problems and potential project feasibility creates serious obstacles to utilizing advance site acquisition to help meet the State's future surface water supply requirements. Additionally, advance site acquisition by the State implies the need for substantial amounts of up-front capital, which could require large front-end general revenue fund commitments or draws on general revenue to meet debt service repayment schedules.

- Need to reconcile anticipated development within an area that may include thousands of acres. Mitigation in advance of losses through a mitigation bank may be a viable option.

**Recommendations for Amendment of the Water Plan**

★ No new recommendations are proposed beyond those in the 1990 Plan.

## 3.6 FINANCING WATER MANAGEMENT

Primary concerns in financing water infrastructure include meeting the costs of achieving environmental goals, ensuring adequate investment to support economic development objectives, and providing for maintenance and rehabilitation of existing facilities. Stringent environmental regulations have increased costs of water and wastewater treatment and solid waste management. Stringent environmental regulations have increased costs of water and wastewater treatment. For example, a recent EPA report shows annualized U.S. water pollution control costs will increase to $64.134 billion in the year 2000 from $24.745 billion in 1980 (1986 dollars). While costs have increased, Federal financial assistance has diminished. Consequently, there is a lack of balance between incentive and regulatory measures. The incidence of these costs has become a major concern, especially to smaller communities and to rural and low income residents. With current funding capabilities, the level of investment in water infrastructure may not be adequate. Some worthwhile local actions will not be funded. There will be limited direct financial incentives for implementation of the Plan. Incremental changes to existing financial assistance programs may not be sufficient to meet the challenge of changing Federal regulatory and tax policies, competing claims for funds, and the emergence of new priorities and problems requiring expenditures. This is particularly true for smaller communities and investor-owned utilities. To address such issues, the 1990 Plan and the Outside Advisory Panel recommend a comprehensive re-examination of the State role in water finance.

In many areas along the Texas/Mexico border and elsewhere in Texas, utility infrastructure is deficient or non-existent. While many of the more sizeable Texas towns and cities have centralized and relatively higher-quality water and wastewater utility service, many of the poorer suburban or rural areas have inadequate utility service or none at all. Along the border in Mexico, this situation is much worse with many of the major towns having substandard, limited service affecting the quality of both jointly-shared public health and water resources. While many rural areas of Texas are currently deficient in quality utility service, these areas are typically not projected to grow rapidly in the future. However, the prospect of noticeably increased population growth along the international border will, unaddressed with sufficient program action, compound the current significant problems of deficient utility infrastructure. The TWDB predicts that water-related infrastructure needs along the border in Texas will total over $4.5 billion in water and wastewater utility needs over the next 50 years.

The State of Texas, the TWDB, and other levels of government have implemented special programs to help address some of these distressed areas. In 1989, the Texas Legislature created

the Economically Distressed Areas Program (EDAP), or more commonly known as the "Colonias" program. This new program was established to provide State-level financial and technical assistance to border cities, towns, and other water purveyors in extending or creating quality water and wastewater utility service. The Legislation also provided that eligibility for the program be conditioned upon the adoption of "model" subdivision rules by the qualifying county such that certain development restrictions or conditions would be required of future development to avoid re-creating the colonias problem with future development. The Texas Attorney General's Office was directed to provide monitoring and enforcement of these model rules.

Most of the counties eligible under this program are located along the international border, although three counties in East and Central Texas qualify under current rules of low unemployment and low per capita income at the county level. This program still leaves many economically disadvantaged areas in Texas unaddressed where the disadvantaged area's county does not meet these county-level criteria. Specialty funding was passed in the 72nd Legislature to address such a non-qualifying area in Southern Bexar County, although many other similar localities in the State have yet to benefit from any such program action.

**Actions Since Adoption of the 1990 Water Plan**

- The TWDB implemented new rules to streamline the State Water Pollution Control Revolving Fund (SRF) in June of 1992 to remove many costly and time-consuming Federal requirements, while still maintaining compliance with Federal statutes. The new loan program is anticipated to provide a more favorable financing option to Texas local governments.

- After several years of start-up activities, eight colonias projects, totaling over $24 million, have been funded for construction by the Board. An additional fifteen colonias projects, potentially serving over 65,000 residents, are targeted for Board funding of over $105.5 million through State bond authorizations approved by Texas voters in 1989 and 1991. Additional funding assistance was recently approved by the U.S. Congress.

- In 1992, TWDB staff have been active in conducting a comprehensive survey of EDAP and border area counties to identify potentially eligible projects. To date, almost 1,200 separate distressed communities or developments with potential water and wastewater needs have been identified in this surveying effort. While substantial, the $250 million of total authorized State funding alone, is insufficient, meeting less than one-half of the estimated needs of $696 million. Additional Federal funds will partially close the funding gap to adequately address this significant public health and welfare problem.

- In addition to the EDAP efforts, Texas has also been working cooperatively with Mexico through the International Boundary and Water Commission (IBWC) to provide centralized utility service to the major urban areas in Mexico along the border. On October 22, 1992 the Board committed $2 million to a joint US/Mexico project for a 31 million gallon per day wastewater treatment plant and associated pump station at Nuevo Laredo in Mexico. The U.S. and Mexico are jointly funding the project, which will help eliminate significant pollutant discharges into the Rio Grande. The treatment plant is nearing the final stages of bidding and construction contract award. Construction is expected to be complete in 1994, and the

facility will be operated by the IBWC. Further international cooperative projects are being contemplated for Reynosa, Ciudad Acuña, Ojinaga, and Ciudad Juarez, Mexico.

- Texas Senate Bill 1189 eliminates mandatory county involvement with financing of water and wastewater project construction receiving financial assistance from the Economically Distressed Areas Program (EDAP).

- Texas Senate Bill 1193 provides $150 million of authorization for the issuance of bonds with specific designation to the Economically Distressed Areas Program (total is $250 million).

- Texas Senate Bill 818 allows Texas Water Development Board to make loans to political subdivisions who loan to individuals for making plumbing improvements.

- Texas House Bill 1 appropriates $4 million of general revenue funds to the TWDB for the provision of emergency financial assistance to areas outside incorporated municipalities in Bexar County so that water and wastewater services can be provided to those residents not connected to centralized systems and where public health concerns exist. Studies are underway to identify the targeted residences.

- In response to Executive Order 12803 on Infrastructure Privatization, the U.S. Environmental Protection Agency is considering making both policy and regulatory changes to encourage and facilitate private investment in EPA-funded municipal wastewater treatment facilities.

- Fee-based funding tied to water rights and wastewater permits was introduced by the Texas Water Commission to support regional water quality assessments.

- The Texas House Committee on Natural Resources interim charge #6 is to "Investigate the best methods of financing water quality initiatives and other environmental protection programs. It includes studying costs of environmental programs in terms of property taxes, fees, or economic development."

- Texas Senate Bill 653 provides for the continued existence of the Water Bond Insurance Program which is an alternative means to support construction of water and wastewater projects in the most economical means possible. The program remains inactive due to the Board's continuing ability to finance water-related projects with the sale of general obligation bonds that allow the Board to offer more attractive interest rates to its eligible borrowers.

- The TWDB funded a flood control loan for beach nourishment in the City of Galveston on July 16, 1992. This was the first use of the Board's funds for that specific purpose under Section 17.011 of the Texas Water Code..

- Texas Senate Bill 1514 authorizes counties with a population of 1,500 or less to spend general revenue funds or issue and sell bonds to finance the county's wastewater collection and treatment system or water supply and distribution system.

- Texas Senate Bill 1197 allows the Board to transfer repayments from the Agricultural Water Conservation Pilot Loans to a variety of funds under the agricultural water conservation programs set up under Subchapter J, Chapter 17 of the Texas Water Code.

- Texas House Bill 1 appropriates $600,000 from the Board's Water Assistance Fund to assist counties with planning for the consolidation of multiple fresh water and wastewater systems. To date, no county has made an application.

- Texas House Bill 1 appropriated $400,000 from the Board's Water Assistance Fund to develop flood control programs for the Sabine River Basin and the Salt Creek Watershed of the Trinity River Basin. The TWDB has awarded contracts to the Wise County and the Sabine River Authority, and the studies are underway. The TWC received funding from another Board appropriation to also implement flood control measures in the Trinity River Basin.

- Texas House Bill 1 appropriates up to $3 million from General Revenue for the Board to match a third of the total project cost for a Canadian River Basin Chloride Control Program, with the limitation that the State's match not exceed the Federal contribution for the biennium.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Establish a new approach to comprehensive water infrastructure financing. | | | ✓ |
| Extend TWDB financial assistance programs to all Texas political subdivisions. | | | ✓ |
| Work with the Texas congressional delegation to amend the provisions of the Federal tax code that limit the use of State tax-exempt financing. | | ✓ | |
| The Legislature/State agencies should continue to support congressional funding for interstate projects designed to improve the water quality of Texas streams and receiving waters of adjacent states. | | ✓ | |
| TWDB, Department of Commerce, and the Governor's Office should establish a clearinghouse to direct local government to sources of financial assistance. | | ✓ | |
| Continue providing districts with alternative non-overlapping methods to develop revenue that can be used to repay debt and support maintenance. | | | ✓ |
| TWC should clarify the ability of local utilities to incorporate reasonable costs of protecting water quality, securing surface water supply, and developing ground-water supplies into utility revenue recovery mechanisms. | | | ✓ |
| TWDB should initiate a nonpoint source pollution financing needs assessment in conjunction with the TWC, TSSWCB, and RRC. | | | ✓ |
| TWDB should inform political subdivisions of the financial assistance programs available to conduct water conservation programs/projects. | ✓ | | |
| Technical assistance functions of State agencies should be expanded to provide help in planning, engineering, finance, and management practices. | | ✓ | |

### Relevant 1990 Water Plan Issues and New Issues

- Due primarily to increasing Federal requirements, the Board anticipates additional demands to occur after FY 1993 for its municipal solid waste financing program that may exceed the current authorization of $239 million available for municipal solid waste projects.

- Pursuant to Federal policy, the TWDB is investigating the possible purchase of Bureau of Reclamation ownership in Texas reservoirs in order to reduce the cost of water to the entities served by the Federal projects.

- The TWDB is also investigating the potential for an interim financing program for non-SRF loans. The program would involve selling short-term or variable rate securities to fund the construction phase of projects, and the selling of long-term securities to refinance the short-term or variable rate securities when a sufficient number of projects had reached completion and long-term market rates were attractive.

### Recommendations for Amendment of the Water Plan

★ Consistent with the Outside Advisory Panel recommendation below, and restating the recommendation from the 1990 Plan, the Legislature should consider a dedicated or continuing source of appropriations or fee-based funding for State investment in water-related infrastructure and environmental resource protection. This new funding could help communities meet heavy financial burdens caused by Federal/State regulations, promote regionalization and its long-term economies of scale, offset the loss of Federal funding of community projects, help small communities that have little financial capabilities, and finance water conservation and reuse innovations, water quality improvements, and environmental protection and project mitigation. The Legislature should also consider supporting repeal of Federal tax law precluding effective financial assistance for certain types of conservation programs currently defined as private benefit.

★ The Legislature should consider the level of available State and potential Federal and private funding sources to provide for inventoried water and wastewater needs of eligible economically distressed areas in Texas, where currently-identified needs are more than two-times currently-authorized State financial assistance. The Board and Legislature should monitor the required State loan/grant ratio to ascertain effects on project feasibility for severely distressed areas. The Legislature should consider providing adequate funding to the Texas Attorney General for enforcement of "model" subdivision rules. The Board and the Attorney General should continue to monitor and identify any weakness in existing law such that appropriate action could be recommended to help prevent recurrence of these utility and related health problems.

★ The Legislature should consider the continuation of the appropriations rider for funding of the Canadian River Basin Chloride Control program through the next biennium by reauthorizing the expenditure of any remaining unobligated funds.

★ The Board and the Texas Water Commission should jointly develop a study to assess the economic impacts of new Environmental Protection Agency guidance and regulations on small utility systems.

- ⋆ TWDB should coordinate efforts with other State agencies to improve opportunities for financing infrastructure and for securing external funds. For example, the Texas Department of Housing and Community Affairs administers the Community Development Block Grant (CDBG) program, which is a potential source of funding for local infrastructure.

- ★ The Outside Advisory Panel acknowledges that there is a definite State role for financial input to subsidize water-related infrastructure and environmental protection and fund water resources management. Requirements should incorporate cost-sharing by local entities. Different levels of assistance should be provided for meeting different public policy goals. Buying down of interest rates to leverage dollars should be encouraged. Examples of areas of compelling State concern include water and wastewater facilities, environmental needs, conservation and reuse, floodplain management, flood protection, research and demonstration projects, and cooperative planning efforts. The Legislature should consider adoption of new revenue mechanisms for the needs identified. Alternative funding mechanisms should be evaluated based on equity considerations, and whether a broad purpose (such as taxes) or a more narrowly defined purpose (such as fee-based) funding mechanism is desirable. The Legislature should consider these issues and related issues during the 1993 session.

- ★ The State should examine potential impediments to privatization of water and wastewater services and encourage privatization of municipal facilities where feasible.

## *3.7 PLANNING, EDUCATION, AND RESEARCH*

### *3.7.1 Water Research*

Changing conditions necessitate consideration of innovative as well as traditional management approaches. Water-related research can provide a systematic approach to introducing new or improved techniques to address water management problems resulting from changing conditions. The 1990 State Water Plan included a discussion of the role research can play in improving water management. Some key points of this analysis include:

- Adequate scientific research should provide a basis for regulatory and other policy decisions at the State level.

- Such decisions affect public health, the environment, the economy, and State and local expenditures.

- Better information is needed to support key decisions.

- Universities in Texas have impressive capabilities to perform water-related research.

- State agencies typically have analytical needs and, in some instances, available funds for research activities.

- Existing links between State agencies and universities can be improved.

- Funds available to support research are limited.

- Cooperation to establish a water resources research agenda is one technique to improve these links.

- A research agenda can be used to **direct** expenditures, to **compare** the adequacy of the State research effort with identified research needs, and to **identify** opportunities for cooperative efforts.

The Texas Water Development Board provides grants for water research. TWDB-sponsored studies have addressed topics such as water reuse, water conservation, marketing and transfer of water, trends in municipal water usage, instream aeration, water yield improvement, water reclamation, socioeconomic impacts, hazardous waste, and dairy pollution. Research grant recipients include universities; local, State, and Federal agencies; and private firms.

Research funding by the Texas Water Development Board provides only a small portion of all water research funded in the State. University-affiliated research institutes perform water, environmental, and coastal research. Other State agencies also fund research efforts. For example, the On-site Wastewater Treatment Research Council funds research and technical transfer to improve on-site treatment systems. The Advanced Research Program and the Advanced Technology Program, administered by the Texas Higher Education Coordinating Board represents the nation's largest competitive, State-supported university research grant program. Environment is a priority research area.

A 1988 U.S. Environmental Protection Agency Science Advisory Board report recommending a significant increase in research funding noted at that time annual nationwide spending on environmental clean-up and protection was $70 billion per year. Additional funding could be justified for research that would assist in the effective allocation of expenditures for environmental protection.

**Actions Since Adoption of the 1990 Water Plan**

- The Texas Water Development Board co-sponsored a workshop with the Texas Water Resources Institute in November 1991 to identify research needs and priorities The following were identified as the top ten priority research needs:

  - Develop and perform procedures to evaluate the effectiveness of Best Management Practice(s) for nonpoint source pollution, including structural/nonstructural controls;

  - Remote sensing of water quality and associated Geographic Information Systems mapping, including locations of contamination sources;

  - Quantify effects of point and nonpoint source discharges on water quality, aquatic productivity, diversity, and ambient toxicity;

- Aquifer management (data collection and interpretation, natural recharge, artificial recharge, etc.);
- Oil wells and their impact on water quality;
- Evaluate water conservation and integrate findings into long-term systems planning (municipal, commercial, industrial, agricultural);
- Nonpoint sources: type and quantities, controlling factors, and water quality impacts;
- Economic, institutional, and legal aspects of innovative water allocation mechanisms, including transfers and market-based pricing;
- Promote a rural agenda for utility issues, funding for preliminary engineering studies and demonstration projects, technical assistance and regional water systems; and
- Hydraulic interaction of streamflow and ground water.

- Since the 1990 Plan, the Texas Water Development Board published Requests for Proposals based on workshop results and received 49 responses. Twelve proposals have been approved for funding, for a total not to exceed $525,686,

- Additional water-related research topics identified from public comments include: water conservation technology, reuse, desalination, and factors affecting water use.

- The On-site Wastewater Treatment Research Council funded two initial projects. One is a study by the University of Texas-El Paso to develop on-site wastewater treatment systems that provide effective treatment with minimal operating costs and maintenance, and the other is a University of Texas study of on-site systems that may work in caliche soils.

- TWDB continues to seek additional sources of funds to support water-related research and demonstration projects. For example, an application was made to the U.S. Environmental Protection Agency (EPA) for a wetlands protection demonstration project grant to study the effects of diverting treated wastewater to nourish an estuary receiving limited amounts of freshwater inflows. Unfortunately, this project was not accepted for funding this year.

  Another project, anticipated to be funded by EPA in the fall of 1992, will determine nutrient interactions and needs in the Trinity Estuary (Galveston Bay) system. Other existing or potential research projects which can benefit from outside funding sources include infrastructure needs assessment in the U.S./Mexico border region, effectiveness of water-efficient plumbing fixtures in reducing water consumption, per-unit costs of production related to various industrial processes designed to conserve water, effective waste minimization techniques, and potential water savings through reservoir system optimization techniques.

- TWDB and TWC participated in a Bureau of Reclamation process to identify research needs for agricultural water conservation (October, 1991).

- The Texas Higher Education Coordinating Board distributed the Advanced Technology Program and Advanced Research Program funds to Texas colleges and universities (October, 1991). Several research projects addressing water or environmental issues were funded through these programs.

- Texas Higher Education Coordinating Board published Research Needs of Texas State Agencies (May, 1991), including needs identified by TWDB in the Water Plan. The Texas Higher Education Coordinating Board is scheduled to publish the second edition of this report in late summer, 1992.

- At the Federal level, congressional actions could increase funding for selected research categories, such as water quality and desalinization.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| A five-year water resources research agenda, to be used as a guide to establish priorities for research funding, should be jointly developed by the Board, other State agencies involved in water management, and State universities. | ✓ | | |
| A base level of at least $1.0 million for State water-related research through the Research and Planning Fund should be available annually to provide continuity and adequate funding levels. | | | ✓ |
| An on-going mechanism needs to be developed to improve the linkage between universities and State agencies to ensure that the most critical research topics are addressed first, studies are not unnecessarily duplicated, and research results are made available to decision makers. At least biennially, the Board in conjunction with Texas universities which have water research institutes, should sponsor a conference to help develop a consensus on water research needs. | | ✓ | |

**Relevant 1990 Water Plan Issues and New Issues**

- There is a need to increase funding for water research activities, better coordinate existing research efforts, improve technology transfer of research results, and strengthen cooperative efforts between business and government.

- Designation of a second Texas estuary as part of the National Estuary Program has occured. Corpus Christi Bay has been nominated by the Governor for inclusion in the program as an estuary of national significance and was accepted by EPA. Federal funding for the project is currently on-hold.

- There is a need to better compile information on previous research, including what other states and countries are doing.

- TWDB will commit the remainder of the State funds for research during this biennium.

**Recommendations for Amendment of the Water Plan**

★ In order to continue research on issues concerning water supply, water quality, flood protection, and water conservation, the Texas Legislature should consider appropriate additional funds for the Board's Research and Planning Fund, since all of the Research and Planning funds available will have been expended by the end of the biennium.

★ TNRIS should establish a clearinghouse for data on research and activities in other states and countries. As an initial step, TNRIS, in cooperation with the Texas Higher Education Coordinating Board, should examine the feasibility of a clearinghouse for research within the State.

### *3.7.2 Environmental Data Collection and Research*

Evaluation and selection of alternative water projects and facilities is increasingly affected by the environmental resources that may be impacted by water development choices. Unfortunately, the capability of all levels of government involved in water resources decision-making to choose among various development, non-development, and mitigation alternatives is limited by the lack of sufficient data and the use of different evaluation techniques. To fully assess and compare the consequences of alternative facility approaches and locations, both issues need to be expeditiously resolved.

**Actions Since Adoption of the 1990 Water Plan**

- As part of the Coastal Management Plan and the Oil Spill Prevention and Response Program, the General Land Office and other agencies are updating current environmental inventories of coastal resources. This will be a coordinated effort with a common analytical methodology.

- The Texas Coastal Ocean Observation Network was created in cooperation with the General Land Office, Corpus Christi State University, and Lamar University to monitor tide levels.

- The Board, Texas Water Commission, and the Texas Parks and Wildlife Department, with assistance from interested local and regional governments, are initiating a springflow augmentation study for Comal and San Marcos Springs.

- The Board's newly-created Hydrographic Reservoir Survey Program will provide data collection and research services. For additional information, refer to "Reservoir Operations and Capacity Maintenance" (Section 3.2.2).

- COMPAS Texas, a microcomputer-based information system that contains detailed coastal resource data and maps, has been developed by the National Oceanic and Atmospheric Administration in cooperation with the Texas Water Commission, the General Land Office, the Texas Water Development Board, the Texas Railroad Commission, and the Texas Natural

Resources Information System to assess the use and health of estuaries in the contiguous United States.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| The State's ability to evaluate circulation, salinity, and water quality in bays and estuaries should be expanded and improved. | | | ✓ |
| Additional funding is needed to expand the State's tide gauge network to include 65 improved gauges. | | | ✓ |
| Adequate funding is needed to collect data on the hydraulic conditions, aquatic habitat, and other environmental resources of rivers and streams potentially affected by recommended water supply projects. In turn, consistent procedures for evaluating instream flow needs and other environmental effects that can be accepted and utilized by all State agencies involved in making environmental resource evaluations of water projects. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- Capability of all levels of government involved in water resources decision-making to choose among various development, non-development, and mitigation alternatives is limited by the lack of sufficient data and use of different evaluation techniques. The State has a range of choices that may be individually or collectively pursued to address the incomplete data and analytical problems affecting sound environmental analysis. The State could: (1) place responsibility for completing required environmental evaluations on the entity promoting the proposed action (i.e., permit applicant), thereby providing the State sufficient information to confirm or refute the environmental evaluations prepared by the entity, or (2) the State's role could range from specifying the data set and procedures to be used to analyze the data to conducting comprehensive environmental resource inventories and establishing, independently from a project sponsor or proponent, the preliminary environmental requirements that would be associated with water development alternatives.

**Recommendations for Amendment of the Water Plan**

★ The Legislature should consider providing increased funding for basic water data collection, especially that which is related to the quantity and quality of the State's surface and groundwater resources. This need is becoming critical given the inadequacy of the current sampling networks and the increasing withdrawal of Federal data collection support.

The various water-related State, Federal, and local agencies should strive to provide for better data collection coordination, consistent data and mapping standards, and more cost-efficient sharing and dissemination of information through improved electronic transfer mechanisms. Funding for the Texas Natural Resources Information System should be expanded to better promote the cost-effective dissemination of natural resources, cartographic, and socioeconomic data frequently accessed by other State agencies and the general public.

Also refer to the "Environmental Uses of Water" (Section 3.5.1) and "Decision Support Systems" (Section 3.7.3) for additional information.

### *3.7.3 Decision Support Systems*

Entities at all levels of government and the private sector rely on various information sources and systems, databases, reports and records, and other decision support systems to make effective planning decisions. Currently, water and environmentally-related decision support systems and activities are spread among various Federal, State, and local governmental entities, as well as the private sector.

In the case of centralized governmental programs, the decision support activities generally lack focus, organization, and an effective information dissemination capability. In the private sector, the activities are often piecemeal, occasional, and may not incorporate some of the latest techniques or accepted methodologies.

**Actions Since Adoption of the 1990 Water Plan**

- Texas Senate Bill 449 provides for biennial review of the State Water Plan. The 1992 update is the first Plan developed since passage of this legislation and it prepares the way for a full, detailed Water Plan in 1994 or 1996. Work underway at consensus planning efforts among the Board, TWC, and TPWD will likely address key planning and policy issues in the 1994 Plan that would likely lead to a complete set of revised planning forecasts included in the subsequent 1996 Plan.

- State and local agencies continue to increase water resource data analysis capabilities of Geographic Information Systems (GIS). The Board's Texas Natural Resources Information System (TNRIS) is taking the lead in converting natural resource databases to GIS format and making them available to interested users. Along with the Texas Department of Information Resources, TNRIS is maintaining a digital cartography/GIS file system on an accessible electronic bulletin board. The Board, primarily through TNRIS, is also providing database support in GIS format to the Texas Water Commission for its Clean Rivers (SB 818) watershed planning and management program. Properly applied, the GIS databases by watershed could become a powerful tool to anticipate potential pollution sources or help solve other water-related problems in the State.

- TWDB established a Liaison Committee with the TWC to maximize coordination and effectiveness and to avoid duplicative and conflicting efforts in the areas of water policy and planning and municipal solid waste. This committee can be the vehicle to coordinate such policy items of mutual interest as ensuring that TWC's permit processes consider recommendations made in the State Water Plan.

- Other decision support systems currently in place or planned for the near future include the following interconnections:

1. Data links, including electronic mail capabilities, with the Texas Water Commission, State Comptroller, and the Texas Legislative Council.

2. Access to the Environmental Protection Agency main network menu.

3. Electronic bulletin boards, including a multi-line general TNRIS board available to TNRIS task force members and the general public. Other bulletin boards now accessible to TNRIS include Texas Department of Information Resources, University of Texas at Austin library catalog, U.S. Bureau of the Census, U.S. Geological Survey, Environmental System Research Institute, Earth Science Data Directory, Earth Observation Satellite and Global Land Information System. Smaller, program-oriented bulletin boards dealing with such things as nonpoint source pollution and the Galveston Bay National Estuary Program are also available to Board staff.

4. Future plans include expanded electronic networking statewide with expanded connections to both Federal and local agencies.

5. An automated records management system at TNRIS would allow better inventory and circulation control of aerial photographs, maps and publications through a bar coding system. A public access catalog and search system, providing easier access to the data by the general public, would also be possible.

These and other new developments in information technology and application play an ever-increasing role in the ability of the Board and TNRIS to plan for the State's water needs.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Consider updating the Water Plan on a two-year revision schedule. | ✓ | | |
| Coordinate and expand technical outreach functions of all State agencies that manage water resource and utilities to provide enhanced and on-going decision support assistance in the areas of planning, environmental assessment, engineering, finance, and management practices. | | ✓ | |
| TWC should better consider, as a part of the State's water rights and wastewater permit review and approval process, the consistency of proposed actions with the principles and conceptual direction of the State Water Plan. | | | ✓ |
| Establish statewide standards for obtaining and sharing geographic information. Texas Legislature should consider directing TNRIS to conduct a review and evaluation of natural resources databases in the State. | | | ✓ |
| TNRIS should expand its role as a central information coordinator and provide better centralized access to natural resources, socioeconomic, and water facilities database information that underlies the State's water planning efforts. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- A larger role for TNRIS is needed as a central information coordinator.
- TWC should consider the Water Plan when granting water rights and wastewater permits.
- Compatibility of proliferating databases is needed.

**Recommendations for Amendment of the Water Plan**

★ No new recommendations are proposed beyond those in the 1990 Plan.

### *3.7.4 Threats and Hazards*

**Drought/Demand Management.** At least one major drought has plagued parts of Texas in every decade of the 20th century. While there is little that individual Texans can do to prevent periods of dry weather and accompanying reductions in available water, there is much that can be done to lessen the impact of future droughts on Texas. Therefore, it is important that State planning efforts consider actions that can be taken to deal with droughts.

**Actions Since Adoption of the 1990 Water Plan**

- Texas Water Commission rules for water conservation will include requirements to incorporate drought contingency planning into required water conservation programs by permit holders.
- Negotiations on the Edwards Aquifer have included discussions about drought measures to be implemented when recharge to the aquifer is low. The TWC, in conjunction with other agencies, are examining conservation as well as the conjunctive use of surface and ground water in order to meet growing demands in the South Central Texas region.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| The Governor should appoint an interagency drought planning task force to develop a comprehensive State drought management plan. | | | ✓ |
| The Legislature should consider amending the Water Code to authorize the TWC to require, where appropriate, preparation of a drought contingency plan in addition to a conservation plan, by applicants for water permits. | | | ✓ |
| All water suppliers and State agencies should incorporate risk-based variable demand analysis as a part of water supply planning. | | ✓ | |
| TWDB should enhance its water conservation and drought contingency planning, education, and technical assistance programs. | | ✓ | |

### Relevant 1990 Water Plan Issues and New Issues

- Existing State policy for drought planning relies primarily on actions by local and regional entities to address drought situations. Therefore, statewide efforts in support of local and regional actions should be coordinated. The State's Emergency Response Plan includes actions to be taken and responsibilities in the event of flooding. However, the Plan does not identify clear directions for coordinating State efforts in case of a major drought.

- The 1950s drought in Texas led to a number of major water resources development initiatives, including a push for the State Water Plan. The early Plans proposed studying several major interstate importation options as a solution to Texas' impending water problems. Texas has since realized that drought planning requires both a long-term look at water supply needs and development to assure a reliable source, conservation to ensure that existing sources are used as efficiently as possible, and planning for short-term supply and management options (drought contingency planning) to have mechanisms readily available should the extent of a drought cause demand to exceed available supplies. In other words, with the increases in population and demand in Texas and the economic, environmental, and physical limitations on supplies and infrastructure development, drought planning can no longer consist solely of increasing supplies and infrastructure to a level that would allow for the worst historic drought conditions. Sound planning must also include long-term water conservation and alternative water supply options and plans to deal with drought situations if they occur through both water management and supply measures.

- State and regional entities have a variety of mechanisms and assistance programs to (1) help assure that long-term supply plans consider possible drought situations, (2) monitor for impending drought conditions, and (3) assist regional/local entities to deal with droughts if they occur. However, these programs are, for the most part, not coordinated.

- Texas ground-water law of private right of capture and control has hindered plans for conjunctive surface water and ground-water systems operations to preclude or lessen effects of a drought. The Texas Water Commission's new authority to enact rules and regulations concerning ground water will play a part in enacting complete management programs for all water resources in an area to prevent adverse drought effects or to deal with the consequences of drought.

### Recommendations for Amendment of the Water Plan

★ The Governor, Lt. Governor, and the Speaker of the House should appoint an Advisory Committee to develop a State contingency and management plan to provide for appropriate regional or statewide responses to reduced water supplies during drought, contamination, or other emergency conditions. Consideration should be given to various structural and non-structural approaches such as providing adequate reserve supplies; demand management techniques, including priorities for surface and ground-water uses; utility interconnections between systems; and other potential response measures.

★ A regional/statewide drought response plan needs to be considered, including the financial, technical assistance, and administrative means to make it happen.

★ Local drought response plans should be put in place at the utility service level. Technical assistance should be provided by the State to develop these plans. The mechanism to put the contingency plan in place will be primarily through financial assistance, rather than rules.

**Intentional/Inadvertent Water Supply and Environmental Contamination.** Maintaining the high quality of Texas' water supplies is an essential part of protecting public health, maintaining adequate supplies, and promoting the economic welfare of the State. The State's surface water and ground-water supplies are, however, subject to inadvertent and, potentially, intentional contamination. Additionally, environmental and economic damage resulting from inadvertent contamination, such as oil spills, necessitates enhanced preparedness and response capability.

### Actions Since Adoption of the 1990 Water Plan

- Senate Bill 14 designates the General Land Office as the lead State agency for prevention of and response to unauthorized discharges of oil and creates the Coastal Protection Fund.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| The TWC should be given legislative authority to direct all public water suppliers to develop emergency water supply contamination contingency plans. | | | ✓ |
| The TWC should require that all new districts with water supply responsibility prepare emergency water supply contamination contingency plans. | | | ✓ |
| All emergency water supply contamination contingency plans should include provisions for coordination during development and implementation with Federal, State, and local emergency response personnel. | | | ✓ |
| Texas Legislature should consider establishing a strong materials spills program. The program, to be coordinated between the TWC, GLO, RRC, and Division of Emergency Management, should include a State-level response fund, emergency response equipment stockpiles, research and technology development efforts, and the legal authority to fully recover actual damages and other costs, including expenses for damage assessment. | | ✓ | |

### Relevant 1990 Water Plan Issues and New Issues

- No new or changed issues were identified by staff.

### Recommendations for Amendment of the Water Plan

★ No new recommendations are proposed beyond those in the 1990 Plan.

**Flood Protection/Damage Reduction.** While flooding causes millions of dollars of damages to property and results in the loss of life nearly every year in Texas, efforts to address flood protection needs have been given only passing attention as a part of the State water planning process in the past. The lack of significant State involvement has occurred, in part, because of an almost exclusive reliance on Federal and local governments to reduce flood damages. However, decreased funding, more narrowly defined interests and commitments, and increased cost-sharing requirements for Federal flood protection programs are pressuring the State to assume a much broader role in reducing flood losses.

### Actions Since Adoption of the 1990 Water Plan

- The Interagency Hazard Mitigation Team, composed of Federal and State agency participants with coordination assistance from the Federal Emergency Management Agency, prepared reports on flooding events in Texas in April 1991, January 1992, and April 1992.

- Texas Senate Bill 1543, by Parker, addresses flood control in the Trinity River Basin. The bill provides that the Texas Water Commission, in conjunction with the Trinity River Authority of Texas, the United States Army Corps of Engineers, and other reservoir owners in the Trinity River Basin, shall develop and implement a coordinated basinwide water release program for flood routing and control. The bill also authorizes land management measures for flood protection by any county with all or part of its area in the Trinity River Basin 100-year floodplain. The Texas Water Commission issued a report entitled "Trinity River Floodplain Study" in September 1992, in accordance with the provisions of this Act.

- Reservoir storage reallocation studies could affect the amount of lake capacity available to accommodate flood conditions. However as part of the requirements of SB 1543, storage reallocation from water supply was reviewed as a concept for flood control, but in general it was felt that flood hazard reduction can be achieved more economically through other approaches. These alternatives avoid having to compete with other reservoir allocations for priority.

- The U.S. Watershed Protection and Flood Prevention Act of 1954 was amended by the 1990 Farm Bill. Cost-share assistance to project sponsors may now be provided by the Secretary of Agriculture in order to enable them to acquire perpetual wetland or floodplain conservation easements which will strive to perpetuate, restore, and enhance the natural capability of wetlands and floodplains to retain excessive floodwaters, improve water quality and quantity, and provide fish and wildlife habitats.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| TWDB should develop and continually update a comprehensive State-level database on existing and projected major flooding problems. | | ✓ | |
| Establish an integrated and comprehensive flood hazard mitigation program for the State. | | | ✓ |
| Authorize all local units of government to develop and use alternative, non-overlapping methods to provide revenue sources to pay for structural and non-structura flood protection measures. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

- There is a need for a single entity at the state level to be responsible for addressing flooding issues.
- Coordination between agencies is often poor at the local level.
- According to the "Trinity River Floodplain Study", (developed cooperatively by the U.S. Army Corps of Engineers, the Trinity River Authority, and the Texas Water Commission), certain Federal Emergency Management Agency (FEMA) administrators have expressed frustration with the inability of the State and some National Flood Insurance Program (NFIP) participants to enforce local regulations and to pursue policies as recommended in hazard mitigation reports. Failure to address the recommendations in the mitigation reports could result in the withdrawal of the NFIP from the participating communities and/or the State.
- Public and local officials, also according to the Trinity study, have complained that FEMA has not provided adequate maps, insurance studies, or training and funds necessary for buyouts of chronic loss areas. Other complaints cite the difficulty in working with Federal guidelines, and have caused some to consider withdrawal from the NFIP.
- Risk of operational failure of the impounding structures of reservoirs and the associated economic impact needs to be assessed on a statewide basis.

**Recommendations for Amendment of the Water Plan**

- ★ Opportunities for new funding alternatives for financing responses to flooding problems, including a one-time assessment that could be applied to structural solutions, as well as consideration of additional funding authority for river authorities, and stormwater or drainage utilities should be evaluated.
- ★ Ways to improve the funding relationships between nonpoint source Best Management Practice(s), aquifer recharge, and flood control measures should be examined.

★ The Texas Legislature, in coordination with Federal programs, should provide funding for monitoring of flood flows, delineation of floodplains, public education, and study of appropriate structural and non-structural management programs to address the major chronic flooding problem areas in the State. The Legislature should consider reviewing State law to seek ways to encourage better local definition and enforcement of floodplain development restrictions, to promote full disclosure of known flooding risks in real estate transactions, to promote better methods for advance flood warning, and incorporate these actions and others into an integrated and comprehensive flood hazard mitigation program. Consideration should be given to the following:

- The Legislature should consider requiring full disclosure of flooding risks in all real estate transactions.
- Facilitate local and regional governments efforts to establish and enforce floodplain development and construction standards, including flood-proofing existing structures.
- State legislation should consider prohibiting construction of residences and businesses that cannot tolerate a flood or will exacerbate flooding within the 100-year floodplain.
- Local governments should develop and implement flood protection plans for flood-prone areas.
- Federal agencies should develop more detailed and specific flood maps.
- The Board should continue to develop and update a comprehensive State-level database on existing and projected major flooding problems.
- The State Emergency Planning office should provide literature and public information on relocation assistance, and how to request assistance on flood fighting, flood recovery, and flood proofing.
- Local governments and TWDB should integrate flood control projects with other projects where feasible, for example incorporating non-structural floodplain management with nonpoint source pollution control, wetlands protection, or with aquifer recharge.
- The Texas Water Development Board should promote the Municipal Drainage Utility Systems Act as a means of reducing or controlling flooding and attendant loss of life and property, and nonpoint and storm water problems.

★ The flood management computer model developed under SB 1543 needs further funding for refinement and a supporting data acquisition system. An operating entity for the computer model also needs to be designated by the Legislature.

**Climate Change.** Global warming could have a variety of consequences for Texas water resources and the socioeconomic and environmental communities dependant upon them. Global climate change could affect precipitation, evaporation, runoff and recharge characteristics, reservoir and run-of-river supply yields, the seasonality of flows, vegetation, fisheries, and coastal sea level rise and flooding within the State. Many of the modeling uncertainties concerning regional effects of global climate change make it difficult to weigh the potential benefits and costs of enacting measures solely to address these particular effects. However, many of the options for addressing the potential water resource effects of global climate change are also appropriate measures needed in many cases today to more efficiently use and manage water, including conservation and drought management techniques, wastewater reuse, systems operations of reservoirs, reservoir capacity maintenance, reallocation of reservoir storage, etc..

**Actions Since Adoption of the 1990 Water Plan**

- The Board is cooperating with other entities, including the Texas Water Commission, U.S. Bureau of Reclamation, the University of Texas at Austin, and the Houston Advanced Research Center, to study possible effects of climate change on water resources.

- The LBJ School of Public Affairs, The University of Texas at Austin, published a report in 1991 entitled Texas and Global Warming: Water Supply and Demand in Four Hydrological Regions. The report noted that water shortages could be anticipated in some areas of the State. Increases in temperature and reductions in precipitation resulting from global warming could exacerbate problems of water supply.

- The LBJ School of Public Affairs of the University of Texas at Austin published a report in 1992 entitled Texas and Global Warming: Emissions, Surface Water Supplies, and Sea Level Rise. This report states that if global warming occurs, it is expected to result in a reduction of available surface water supplies. The potential impacts of global warming might require departures from current policies and the adoption of innovative management responses.

- The Board and TWC staff are participating in a review of potential effects of global warming on water resources, coordinated by the Congressional Office of Technology Assessment.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Water resources planning and investment decisions should incorporate climate uncertainty as a formal variable and identify alternatives to provide Texas with the greatest degree of flexibility to respond to variable climate change impacts. | | ✓ | |
| The Governor, Lt. Governor, and Speaker of the House should establish an advisory panel, chaired by the TWDB Chairman, to develop formal recommendations on how State policy, and programs should be revised to respond to potantial impacts of climate change. Recommendations should be presented to the 73rd Texas Legislature. | | ✓ | |

**Relevant 1990 Water Plan Issues and New Issues**

- As recommended in the 1990 Plan, water planning and investment decisions should consider climate uncertainty and attempt to identify alternative actions that will provide Texas with the greatest degree of flexibility to respond to variable climate change impacts.

- As recommended in the 1990 Plan, a panel should be designated to consider if any legislative or programmatic changes should be made to respond to impacts of possible climate change.

**Recommendations for Amendment of the Water Plan**

★ No new recommendations are proposed beyond those in the 1990 Plan.

### *3.7.5 Federal/State Relationships*

Many factors influence interactions between Texas and the Federal government. As several State agencies share similar water management responsibilities, there is no assurance that consistent State policy will be expressed when dealing with Federal agencies. Further, Federal water policy is divided among three Cabinet-level departments and many independent agencies. Some Federal water agencies are modifying their historic roles. While Federal agencies are providing less financial assistance to states, Federal regulations continue to impose significant costs on state and local governments. Certain Federal actions can limit water supply alternatives.

**Actions Since Adoption of the 1990 Water Plan**

- The 5th Circuit Court, and subsequently the U.S. Supreme Court, denied the Sabine River Authority and Texas Water Conservation Association appeal in litigation regarding the conservation easement located at the site of the proposed Waters Bluff Reservoir.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| The Legislature should consider establishing that the TWC's contested case decisions represent Texas' position on issues in any Federal proceedings. | | | ✓ |
| To influence Federal action that may have significant impacts on Texas, State water agencies should work closely with the Texas congressional delegation, the Office of State-Federal Relations, and trade organizations. | | ✓ | |
| The Legislature should work with the Texas congressional delegation to enact legislation to ensure that federal government acceptance of non-development easements through its preservation programs does not preclude needed water projects if the project benefits outweigh the environmental benefits. | | | ✓ |
| Annual coordination conferences involving water and wildlife agencies should be held to address potential water resource and environmental conflicts. | | ✓ | |

**Relevant 1990 Water Plan Issues and New Issues**

- No new or changed issues are identified by staff.

**Recommendations for Amendment of the Water Plan**

★ The implications of non-development easements on other potential reservoir sites, such as the Waters Bluff Reservoir site, should be evaluated as part of the 1994 Water Plan update.

### *3.7.6 Water Planning Purpose and Coordination*

As stated in the 1990 Plan, agreement on the precise purpose of the Water Plan is necessary to define the scope and content of future Plan updates. The 1990 Plan differed from previous efforts in emphasizing innovative, as well as traditional, water management techniques, presenting problems and recommendations from several geographical perspectives, and incorporating both water project recommendations and necessary policy changes.

Ensuring coordination in water planning in a large state such as Texas can be difficult, given the diversity of geographic needs and the large number of affected interests. To add to this difficulty, several State, regional, and local entities all manage water to some degree in Texas. According to the TWC and other sources, more than 30 kinds of special water districts have been created, as well as 21 river authorities formed by the Legislature, and more than 1,000 separate governmental entities are involved in water management at the local level. Five State agencies are involved in some aspect of water-related planning, management, finance, or regulation. Several Federal agencies have direct involvement in Texas' water management, as well.

To help address problems of coordination between the various entities, several State programs have coordination requirements. For example, the Texas Parks and Wildlife Department (TPWD) reviews draft wastewater permits proposed by the TWC. Other examples are statutes that require municipal solid waste plans to be consistent with the State plan, and regional plans that are required to be adopted as rules. Coordination and public input is built into this process. Other programs are not as well coordinated between governmental entities, the regulated/user community or the general public. Since the myriad features and properties of water are inseparable, the various managing governmental entities should attempt to deal with the resource on a more holistic basis, rather than in a piecemeal fashion. This requires dialogue between the various planners, regulators, and others in the water industry, including the general public. Inter-governmental review of permits, plans, programs, rules and implementation procedures should be expanded and begun earlier in the process to ensure holistic solutions to basic water needs.

State agencies that should be involved in close program cooperation include the Board, TWC, TPWD and possibly the General Land Office (GLO) for its coastal resource management responsibilities (see 2.3.5, "Environmental Uses of Water"). The Railroad Commission (RRC) and Texas Department of Agriculture (TDA) are other agencies to be consulted on matters pertaining to their oil field brine discharge and pesticide registration programs, respectively.

Several of these agencies also offer technical assistance to the regulated/user community such as water or wastewater system operational assistance or planning/program assistance. These technical assistance programs should also be coordinated between agencies to avoid duplication of effort and to maximize resources. Each agency should concentrate its efforts in its areas of expertise or statutory authority. The end result should be better service to the citizens of the State and more informed decision-making at all levels of government.

**Actions Since Adoption of the 1990 Water Plan**

- Senate Bill 449 directs the Texas Water Development Board to review the State Water Plan every two years to consider any amendments or modifications.

- In accordance with Senate Bill 818, river authorities are to assess past, existing, and potential future water quality conditions by river basin.

- State agency re-organization consistent with Texas Senate Bill 2, has and will consolidate certain environmental and water responsibilities.

- TWDB has organized an Outside Advisory Panel to assist it with development of the 1992 update to the Texas Water Plan. The Panel also focused on identifying and prioritizing water resource policy issues that may be addressed in more detail in the 1994 Plan. Panel membership included persons from various levels of government, environmental groups, water suppliers, user groups, and others. A diverse membership was used to provide a broad representation of opinions and interests with the expressed goal of giving balance to the Plan.

- The Board has actively sought public input and participation throughout the water planning process. For example, approximately 100 information requests for suggestions on water policy matters and topics of concern to be considered for inclusion in the 1992 Water Plan Update were mailed to a wide cross-section of people throughout the State with expertise or interest in various water issues. In addition, the Outside Advisory Panel was involved in identifying priority water policy issues and coordinated draft material for the Water Plan Update with their respective organizations. A preliminary draft of the update was distributed for review in advance of seven public meetings held around the State during September, 1992. An overview of the draft Water Plan Update was given at each meeting and input from the public was requested. Revisions were made to the draft update based upon comments received, and a final draft of potential revisions were presented at a more formal public hearing in October. Final changes to the Water Plan Update were made following the public hearing and the Plan was presented and adopted by the Board at its November meeting. A revision to the Water Plan is anticipated for 1994 focusing on consensus planning and policy issues among the three major water agencies, with an equal or greater amount of public involvement. A full update of the Plan, including revised forecasts including consensus planning assumptions, is anticipated by 1996.

- TWDB established a Liaison Committee with the TWC to maximize coordination and effectiveness and to avoid duplicative and conflicting efforts in the areas of water policy and planning and municipal solid waste.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| Texas Legislature should consider establishing a Water Resources Coordinating Council, as originally recommended in the December 1988 Report of the Governor's Committee on Water Resources Management, to encourage coordination by water and related resource agencies. | | | ✓ |
| State Water Plan updates should be prepared by the Board on a regular two-year interval. | ✓ | | |
| TWDB should be adequately funded to develop a broader and more comprehensive on-going process for identifying and monitoring emerging water management issues so they can be incorporated into future Water Plan updates. | | ✓ | |
| TWDB should establish a process that promotes early and full public involvement in all updates of the Water Plan. | | ✓ | |
| TWDB should further develop and document sound and consistent planning criteria to be used in updating future Water Plans. | | | ✓ |
| Expanded interagency coordination is needed to avoid conflicts between the Water Plan and other State-prepared plans relating to water resources. The Board should develop more formal procedures, working arrangements, or agreements that establish how key water-related recommendations from plans prepared by other State agencies will be incorporated into updates of the Water Plan and vice-versa. | | ✓ | |

**Relevant 1990 Water Plan Issues and New Issues**

- ► There is a need to determine how to coordinate water quality assessment recommendations with water planning recommendations.

- ► An institution is needed to coordinate State water policy and related natural resources policy.

**Recommendations for Amendment of the Water Plan**

- ★ The Board, Texas Water Commission, and Texas Parks and Wildlife Department, in consultation with State leaders, other appropriate agencies and commissions, and the public, should continue and expand their joint efforts to assess and address key water planning and development issues facing the State, in particular the development, production, and coordination of the 1994 Water Plan. Under the Board's statuatory leadership, key coordination elements that should be immediately addressed by the agencies to provide for significant planning goals being acheived by 1994 include necessary scheduling requirements, agency resource commitments, agency mandates and roles, decision-making criteria and processes, and the screening of planning and policy framework issues. Once developed and

adopted, these mutually-derived planning findings should be supported by the State, where feasible, in regulatory proceedings.

★ The Board and TWC should continue coordinating their technical assistance functions to assure the efficient provision of services and to avoid any potential duplication of effort between the differing regulatory and planning/financial technical assistance functions of the two agencies.

### *3.7.7 Environmental Dispute Resolution*

Because of the limited resource constraint and the many potentially disparate interests involved, water issues are, by their very nature, contentious. Some degree of conflict is inherent in the desires of different regions, users, and levels of government to exert control over limited supplies of water. In recent years, strong public support for protecting environmental values has clashed with other competing water demands, with these conflicts often leading to litigation. As an alternative to an increasing number of adversarial proceedings, dispute resolution through consensus-building techniques has been increasingly employed with demonstrated success.

**Actions Since Adoption of the 1990 Water Plan**

- No significant actions since the 1990 Plan have occurred.

| 1990 Policy Recommendations | Implementation Status | | |
|---|---|---|---|
| | Full | Partial | None |
| The State Management Development Center should offer training on environmental dispute resolution for State agencies for natural resources and for those agencies constructing major projects subject to environmental review. | | | ✓ |
| Texas Legislature should consider evaluating the Open Meetings and Records Act tc identify any legal impediments to the use of dispute resolution approaches and techniques. | | | ✓ |

**Relevant 1990 Water Plan Issues and New Issues**

► Management of the Edwards Aquifer has been controversial for many years with competing users representing the San Antonio urban area, agricultural irrigators in counties to the west, and recreational interests dependent on springflow from the Aquifer, unable to reach a consensus. Attempts to negotiate a regional management plan between San Antonio and the Edwards Underground Water District ended unsuccessfully in 1988. Legislation to accomplish somewhat the same purpose was defeated in 1989.

The parties, aided by the Texas Water Commission, succeeded in establishing a drought management plan in 1990, but again failed to reach a consensus on a regional water management plan. In late 1990, an agreement was reached with the Texas Water Development Board to fund a dispute resolution process using the services of a professional mediator selected and agreed upon by the previous parties as well as downstream industry, river authorities, and Texas Parks and Wildlife Department. This process was eventually terminated by mutual agreement between the parties when consensus was not reached. However, the process was an important step as it was one of the first times environmental dispute resolution had been attempted in Texas.

- On April 15, 1992 a South-Central Texas Water Resources Planning Council was established, comprised of representatives of State, regional, and local governments, representatives of the people and enterprises served directly or indirectly by the Edwards Aquifer, and representatives of established environmental groups. Because of the sensitive nature of the negotiations on the management of the Aquifer, an outside mediator is again assisting in the development of a water resources management plan.

- A wastewater permit dispute between a petrochemical plant near the City of Sweeny and local citizens' interest groups was referred to a panel of scientists for binding arbitration during the summer of 1990.

**Recommendations for Amendment of the Water Plan**

- No new recommendations are proposed beyond those in the 1990 Plan.

## 4.0 AREA/PROJECT ASSESSMENTS

As previously mentioned, some areas of the State have experienced significantly changed conditions in their water demand, supply, or facility needs that may necessitate a near-term amendment of the Water Plan because of current problems requiring immediate attention or the time-line involved in adequately addressing future major facility problems within the 30-year planning period. Where recent changes have not yet sufficiently manifested themselves as affecting long-term trends or appear to result in a changed modeling assumption that affects the 30 to 50 year planning horizon, the Board's staff feels these are not yet significant enough to warrant frequent amendments to the Plan. The Plan must stay as current and relevant as possible to actions needed in the near-term, but not be undermined as a relatively stable planning document by frequently changing, long-term assumptions making its forecasts volatile and less useful for longer-term planning.

Continuing with the planning goals of the 1990 Water Plan, the assessment of area and project changes since the last Plan have also incorporated mechanisms for considering more non-structural (e.g., conservation, reuse) and non-traditional means (transfers, reallocations, etc.) of addressing water supply problems before recommending more environmentally-significant reservoir construction as a means of providing for remaining needs.

It should be emphasized that for certain projects recommended in the 1990 Plan where no significant events have transpired since 1990, these projects have not been further assessed for potential revisions to the Plan in this document. Those recommended projects referenced in the 1990 Plan, not specifically amended in the 1992 updating process, are still valid recommendations of the Texas Water Plan.

## 4.1 AREA ASSESSMENTS

### 4.1.1 Areawide Flooding Problems in Texas

As discussed in the 1990 Water Plan, Texas has one of the most severe, chronic flooding problems in the United States. As has been the case historically, devastating floods in late 1991-early 1992 ravaged large areas of the central, north central, northeastern, and coastal areas of Texas. Since the 1990 Water Plan, some further actions have been taken to address these chronic flooding areas. The Legislature provided special appropriations through the Board and the TWC to provide for regional flood studies on the Middle/Lower Trinity River, the lower Sabine and Neches rivers, and in Wise County north of Ft. Worth. The Board also continued funding of the areawide flooding study on the Upper Trinity River, in cooperation with the U.S. Army Corps of Engineers and local interests. The Corps also has a major areawide study underway on the Middle/Lower Trinity River. All of these study efforts are at various stages of completion and involve both structural and non-structural measures to address these major flooding problems.

### 4.1.2 Coastal Bend Region (Nueces and Neighboring Counties)

The region composed of the area served by the Lake Choke Canyon/Corpus Christi reservoir system has been recently re-evaluated due to new information on hydrology, sedimentation, and permit considerations. The reservoir system is estimated to be able to develop 196,000 ac-ft/yr without any consideration of releases for bay and estuary purposes. When the present rules for bay and estuary releases are considered, the supply available is reduced to 154,000 ac-ft/yr. These rules call for the delivery of at least 97,000 ac-ft/yr by a combination of releases and spills from the reservoir system and return flows from the City of Corpus Christi and other users of the system. The rules allow for relief from releases during times of drought based on the City's water conservation and drought contingency plan. These release rules are valid for five years, at which time they can be reviewed for appropriateness of the prescribed measures and the effects they are having upon the reservoir water supply and downstream estuarine systems. The City, with Board funding, is evaluating methods to increase the amount of return flows delivered to the estuary such that required releases from the reservoir system could be potentially reduced.

Assuming that the available system supplies are limited to 154,000 ac-ft/yr, the City's regional water utility system would need additional supplies by the year 2000. The Port of Corpus Christi Authority has entered into an option agreement with the Lavaca-Navidad River Authority to purchase uncommitted supplies in Lake Texana near Victoria. It is anticipated that a new conveyance system to Lake Texana to supplement Coastal Bend water supplies would be completed by 1996. Corpus Christi is also evaluating other supply options for the long-term including purchasing water from the Garwood Irrigation District, development of the Applewhite project near San Antonio, development of resources in the Guadalupe River Basin, and development of additional supplies in the Nueces River Basin.

### 4.1.3 Critical Area #2 (Texas Hill Country)

In the Texas Hill Country west of Austin and north of San Antonio, the severity of current and potential future ground-water supply problems has been evaluated by the TWDB and TWC, resulting in the Commission designating this region Critical [groundwater] Area #2 . Declining water levels and/or poor water quality confront many of the communities and rural areas of this region. The Critical Area report recommends the communities in the critical area, such as Fredericksburg, Johnson City, Blanco, Kerrville, Comfort, Ingram, Boerne, Wimberley, Dripping Springs, and Bandera, plan for conjunctive use of surface and ground water as a means of extending limited ground-water supplies and improving water quality. For those communities in western Hays County, extension of City of Austin service or service from local water districts or corporations with surface water sources appears to be the most feasible means of addressing these problems. Some portions of this overall area could be provided with surface water supplies from the Lower Colorado River Authority, but might require an amendment in their designated service area. As referenced in the 1990 Water Plan, communities in Bandera County should consider securing supplies from nearby Lake Medina.

### 4.1.4 Economically Distressed Areas and Related-Border Infrastructure

In many areas in Texas along the border, water-related utility infrastructure is deficient or non-existent. Water quality is noticeably degraded in various reaches of the Rio Grande and is suspected, in part with other pollutants, as a contributing factor to a variety of health problems manifesting themselves in this area. While many of the more sizeable Texas towns and cities have centralized and relatively higher-quality water and wastewater utility service, many of the poorer suburban areas have inadequate utility service or none at all. In Mexico, this situation is much worse with many of the major towns having substandard, limited service. Exacerbating current problems is the prospect of even greater utility infrastructure needs along the border arising from future growth. The TWDB predicts that water-related infrastructure needs along the border in Texas will exceed more than $4.5 billion during the next 50 years.

The State of Texas, the TWDB, and other levels of government have implemented special programs to help address these distressed areas. In the late 1980s, the Texas Legislature created the Economically Distressed Areas Program (EDAP), or more commonly known as the "Colonias" program. This new program was established to provide State-level financial and technical assistance to border cities, towns, and other water purveyors in extending or creating quality water and wastewater utility service. Texas voters approved $100 million of bond authorization in 1989 and an additional $150 million of authorization in 1991 to support this program. After several years of start-up activities, eight colonias projects, serving more than 20,000 residents and totaling more than $24 million, have been funded for EDAP construction, as of August 20, 1992. Fifteen other colonias projects, potentially serving over 65,000 residents, are targeted for $105.5 million of construction. In 1992, TWDB staff have been active in conducting a comprehensive survey of EDAP and border area counties to identify potentially eligible projects. To date, almost 1,200 separate distressed communities or developments, with water and wastewater needs of over twice the available Board EDAP funds, have been identified in this surveying effort. The estimated cost of these inventoried needs for water and wastewater service, connection fees, and indoor plumbing totals more than $696 million. The Federal government has recently authorized, but not yet funded, $50 million in the EPA budget and $25 million in the FmHA budget for colonias improvements. However, even with this level of additional Federal support, and what might be allocated to Texas, available funding is still not adequate to meet inventoried needs.

In addition to the EDAP efforts and as previously mentioned, the State of Texas has also been working cooperatively with the government of Mexico and the International Boundary and Water Commission (IBWC) to provide major utility service to the major urban areas in Mexico along the border. The State of Texas has committed up to $2 million to a joint US/Mexico project for an approximate 30 million-gallons-per-day wastewater treatment plant and associated sewer line work at Nuevo Laredo in Mexico to help remedy significant pollutant discharges into the Rio Grande. The project is nearing the final stages of design and financing approval. Construction is expected to be complete in 1993, and the facility would be operated by the IBWC.

Further aggressive efforts are needed to address the significant water quality problems in various river reaches along the Rio Grande. Inadequate or improper disposal of both municipal and

industrial wastes into the river has raised significant health concerns in certain areas which could be compounded even further by anticipated growth in the region. Other international cooperation utility projects are being contemplated in Reynosa, Ciudad Acuña, Ojinaga, and Ciudad Juarez, Mexico.

### *4.1.5 El Paso Region*

Planning for the El Paso region's water needs in the 1990 Plan included aggressive water conservation measures, continuing and expanded use of area ground-water supplies, increased wastewater reuse and artificial ground-water recharge, continued use of existing Rio Grande supplies, and additional surface water supplies through conversion of irrigation water rights to municipal uses. The City anticipates that its reuse-recharge project could recharge up to 10,000 acre-feet per year to the Bolson and further anticipates other additional reuse possibilities increasing supplies by about 35,000 ac-ft/yr. The City also anticipates water conservation savings of about 50,000 ac-ft/yr by the year 2040. The 1990 Water Plan found a regional deficit of future water supplies of about 70,000 ac-ft/yr by the year 2040.

As identified by the City, primary alternatives that could address this deficit include development of additional reuse, additional regional ground-water supplies, change of upstream reservoir operations, improvements in the surface water delivery systems, and potentially, desalinization options. Since the 1990 Plan, the City of El Paso has pursued the optioning of 24,000 acres of land for regional ground-water supplies that could provide an additional 15 years worth of supply needs, has worked with area water districts to promote the conversion of irrigation rights to municipal uses as a condition of water utility service extension, and is examining various alternatives for expanded use of upstream surface water supplies. A water task force, formed by the Rio Grande Council of Governments, has promoted dialogue among competitive users of regional water supplies.

In March of 1991, a Memorandum of Understanding (MOU) was agreed upon between the City of El Paso and New Mexico entities that settled a long dispute over regional water supplies. The bi-state MOU provided for the parties to work together to identify, study, and address common water supply concerns; examine the potential for construction and financing of conveyance facilities from Caballo Reservoir in New Mexico; to work together to maximize use, improve operation, and examine facility improvements of the federal Rio Grande Project; and various other aspects related to improved communication and regional planning. In addition to this statement of bi-state cooperation on mutual water resource issues, the Board recommends even broader regional water supply planning on a bi-national and bi-state basis that involves Mexico, New Mexico, and Texas in a cooperative regional planning effort on the development and protection of regional surface and ground-water supplies. The amended Plan should note these recent developments.

### 4.1.6 Houston-area Subsidence

In April 1992, the Harris-Galveston Coastal Subsidence District adopted a new district plan to control subsidence in the two counties. The new plan calls for seven regulatory areas (down from the previous eight areas), and changes the time frame for implementation of conversion to surface water sources and the percent of total water use that can be supplied by groundwater. Preliminary analysis of the new plan indicates that the timing for new projects to serve the Harris-Galveston area would not change; however, the volumetric needs utilized in the 1990 Plan may change somewhat. No change is recommended in the Plan at this time.

### 4.1.7 North American Free Trade Agreement

A recent issue of major concern is the potential North American Free Trade Agreement (NAFTA) and its potential effect on the separate and jointly-shared water resources and water-related infrastructure of the United States and Mexico. A number of impact assessments of NAFTA have been initiated at many levels of government, as well as in the academic community. A diverse array of opinions exist as to the potential effects of NAFTA upon economic development (and consequently upon water resources) in the immediate area of the international border. While most analysts generally agree that significantly-increased economic activity between the two nations will result from NAFTA, the location and spatial distribution of this growth has generated some debate. Federal impact assessments have modeled various scenarios ranging from noticeably increased development along the border to a scenario of development moving away from the border and into inland areas of Mexico and the U.S.. The exact future is somewhat unclear, although it is likely that in either of these two more extreme scenarios some additional development will occur along the border because of increased international transportation and associated retail trade.

U.S./Texas industries such as apparel, textiles, leather, and some food processing may likely be negatively affected by lower labor costs in Mexico while most other U.S./Texas industries could generally benefit from the anticipated increased trade with Mexico. Consequently, most Texas industries identified to exhibit relatively slower or higher growth in the TWDB's forecast in its 1990 Texas Water Plan still appear to be valid. Those industries anticipated to experience relatively higher growth over the planning period are plastics, electrical machinery, non-electrical machinery, paper products, and chemicals, while manufacturing industries such as textiles, leather, apparel, primary metals and various food products are anticipated to experience slow growth over the planning period. In one study, among the predicted "big winners" of industries receiving increased stimulus from NAFTA are the electronics/communication-related and aircraft parts industries, many of which are located in more inland areas, such as the Dallas/Ft. Worth metroplex (LBJ School of Public Affairs., University of Texas at Austin, 1992). At this time, no substantial change appears warranted in the Board's forecast for border-area manufacturing water demand beyond the growth allowances provided in our 1990 forecasts.

Predictions of NAFTA's affect on Texas' agricultural industries are also mixed. Some sectors, such as livestock and feed grains, may experience growth as Texas producers increase exports

of these commodities to Mexico. For producers of some types of vegetables and fruits, competition between the two countries' producers is likely to increase. Much of the livestock and feed grain production in Texas occurs in non-border areas, although aggressive, lower-cost competition in the vegetable and fruit markets may result in decreased water demands for irrigated agriculture in the Lower Rio Grande Valley of Texas.

Water demand for municipalities would also likely be affected by NAFTA. The population of the border has been increasing at a steady rate even without the Free Trade Agreement. As previously mentioned, increased transportation and retail trade will likely continue to stimulate the economies of border cities even with differing locations of industrial development. Should future industrial location also cluster along the border, even higher rates of growth in municipal populations and water demand would be evidenced in both Texas and Mexico. While there is still some potential for additional ground-water development in the middle and upper Rio Grande, most of the more significant future municipal water supplies will likely result from conversion of surface water used for agriculture to municipal purposes as water prices are bid up by cities and towns to pricing levels beyond limits affordable to farmers. This conversion from agricultural to urban uses, already occurring, is likely to accelerate and provide the major basis for meeting municipal demands along the border in the foreseeable future, with or without the effects of NAFTA.

Less well known is the impact of how future development patterns on the Mexican side of the river might affect jointly-shared surface and ground-water resources. Significant ground-water pumping of the Hueco and Mesilla Bolsons in the Ciudad Juarez area will likely have a direct effect upon supply availability for the City of El Paso. Expanded use of Rio Grande surface water supplies allocated to Mexico in the international treaty will likely reduce "surplus flows" in the river currently utilized by U.S. farmers in the Lower Rio Grande Valley. Additional use of Rio Grande supplies, potential new surface water development on the tributaries in Mexico contributing flow to the Rio Grande, and the types of water use and return flows to the river and its tributaries resulting from increased trade and development could exacerbate salinity problems in the lower basin to more significant levels.

### *4.1.8 Red River Waterway Extension into Northeast Texas*

The U.S. Army Corps of Engineers is studying the feasibility of dredging a $680 million commercially-navigable waterway that would connect the Texas town of Lone Star with that of Shreveport, Louisiana. This potential new channel (termed the Daingerfield Reach) would link with a $1.8 billion barge canal currently under construction that would open the Red River to year-round shipping traffic from Shreveport to the Mississippi River and on to New Orleans and the Gulf of Mexico by the end of 1994. The waterway extension into Texas would be 75 river miles long and from 9 to 12 feet deep. The Corps is studying various alternative configurations that could affect the sizing, routing, and method of barge tow transfer at the potential dams, as well as concerns related to overall environmental impact, method of dredge material disposal, updated economic analyses, and other issues. If feasible, permitted, and if funding continues, construction would begin in late 1996, with the first year of full operation by the year 2005. Proponents of the

project support the projected economic stimulus for the economically depressed region (an estimated 40,000 new jobs by one earlier study, currently under re-study), and believe the potential environmental effects are acceptable. At this time, the Water Plan should not be amended as it relates to this project until more detailed and current studies are completed.

### *4.1.9 Southern Edwards Aquifer Region (Bexar and Neighboring Counties)*

On the regulatory and legal front, much has happened since the 1990 Plan. Currently, high and increasing levels of ground-water demand and occasional dry periods have increasingly threatened springflow maintenance. Federal and State lawsuits over endangered species protection and "underground river" designation have heightened the issues to the point of necessitating State intervention to hopefully preclude Federal action. After repeated attempts and failure to develop a regional consensus for action, the Texas Water Commission in April 1992 declared the southern Edwards Aquifer an "underground river," which means the water in the southern Edwards is subject to State regulatory control. The TWC then began the process of promulgating and implementing an "interim" management plan of pumping limitations, conservation, and other water management strategies to help minimize the probability of cessation of springflow during prolonged dry conditions. In September 1992, State District Court ruled against the legality of the TWC's Underground River designation. Further action on appeal of the lower court ruling is pending. Testimony on a separate Federal lawsuit, related to Endangered Species, was completed on November 19, 1992 with a decision expected by the end of the year.

The TWC had previously called, by resolution, for the formation of a South Central Texas Water Planning Council to develop a long-term management plan for the area that would provide sufficient water supplies for the region. Since that time, inter-agency and local efforts to develop the study elements of the South-Central portion of the overall Trans-Texas Study have essentially supplanted the need for the formation of the South Central Texas Water Planning Council. The South-Central Trans-Texas study would be directed overall by the three State water agencies (TWDB, TWC, and TPWD) and involve Aquifer users, other municipalities with long-term water needs, and other interest groups. This effort will look at a variety of traditional and more non-traditional supply and management options, including enhanced recharge and artificial springflow augmentation. It is the intent of the State water agencies to coordinate these Edwards regional study elements with the assessments of the previously-discussed Trans-Texas Water Program studies to assure integrated and comparable results so that rational choices can be made as to local, regional, or inter-basin alternatives to address the current and future supply of the south-central Texas area. The early discussion of forming the Planning Committee is underway with the intent of having proposed long-term supply plans for the area ready by the publication of the next Water Plan in late 1994.

The 1990 Water Plan recommended conservation and reuse programs and a conjunctive-use supply management plan for the Southern Edwards Aquifer Region to provide for more limited pumping of groundwater and protection of area springflows. The Board's Edwards Aquifer simulation model available at the time of the 1990 Water Plan was used to recommend a 425,000

acre-foot per year regional pumping level to protect springflow. However as stated in the 1990 Plan, the simulation model available at that time was limited in several respects; most notably using an annual "time-step" function to portray a very dynamically-responding resource, and the Board expressed concern that the 425,000 ac-ft/yr recommended pumping limit was too high to adequately protect springflow at a desired level.

Since that time, considerable effort has been focused on expanded study and management initiatives. More recent detailed study of conservation and reuse potential has resulted in a staff recommendation that the Plan be revised to reflect higher conservation savings of 100,000 ac-ft/yr for municipal/manufacturing uses and 60,000 ac-ft/yr for irrigation uses by the year 2010, as well as provision of 40,000 ac-ft/yr through reuse by that time. Even with increased conservation and reuse, a regional average high-end pumping limit of 425,000 ac-ft/yr from the Edwards would necessitate the development of significant new supplies. The 1990 Plan recommended that additional supplies be obtained through the acquisition of Lake Medina water, development of the Applewhite, Cuero, Lindenau, and Goliad reservoir projects, as well as acquisition of other area groundwater and interbasin surface water supplies. Further supply or management options could potentially include springflow augmentation, conjunctive use management, and aquifer recharge enhancements. Previous investigations have indicated that as much as 96,000 acre-feet of water could be recharged during average conditions in the Edwards portion of the Nueces River Basin. During times of drought, recharge volumes would be less, and this enhanced recharge would have impacts on downstream water rights, instream flows, freshwater inflows to the bays and estuaries, as well as construction-related effects associated with reservoir development. Studies are underway to obtain similar recharge information in the Edwards Aquifer area of the San Antonio and Guadalupe river basins.

More recent yield analyses indicate that supplies available from Lake Medina should be adjusted to 29,000. Although Board staff still believe that the Applewhite project will provide a strategic role as a proximate site for terminal storage from other more distant supply sources, as well as its own limited supply source, the City has adopted an ordinance discontinuing construction of the Applewhite Reservoir following a voter referendum. If the City does not resume the Applewhite project, San Antonio will need another source of surface water similar to that which would have been supplied by the Applewhite project. Supply availabilities from the potential Lindenau Reservoir project should also be revised to 107,000 ac-ft/yr as a result of changes in diversion modeling and a lower pool elevation to protect valuable environmental habitat. Potential environmental permit problems with the Cuero site should again be noted. The potential Goliad project would still play a viable, significant role in the region's future water supply.

Since 1990, the Board has improved its aquifer modeling and ground-water level forecasting capability. Our more recent studies of the Edwards using the updated model indicate that a sustained pumping limitation of approximately 165,000 acre-feet per year for the region would be required to provide for guaranteed springflows of about 100 cubic feet per second (cfs) at Comal Springs in New Braunfels and 50 cfs at San Marcos during a repetition of the drought of record. This modeling result assumes no significant contribution from any potential enhanced aquifer recharge (which would essentially be zero during a severe drought) or from artificial springflow

maintenance. Should a decision be made to provide adequate springflows at these preliminarily-determined biological needs levels, further efforts would be required to replace these substantially reduced supplies. The Lindenau project's supplies could be increased from 107,000 to 207,000 ac-ft/yr through downriver recapture of the guaranteed springflows. Supplies from the potential Goliad Reservoir would need to be increased through greater use of return flows as well as advancing its need to the year 2010. Even with these measures, an additional 60,000 to 100,000 ac-ft/yr of supply deficiency would have to be addressed through other means, such as new supplemental supplies from more distant sources, drought management, and/or temporary use of agricultural water supplies by municipalities during extreme weather conditions.

### *4.1.10 Trans-Texas Regional Water Issues*

During the planning process of the 1990 Water Plan, Board staff became increasingly concerned with the difficulty of meeting long-term future water demands in the South Central and South Texas regions. By the end of the 50 year planning horizon, and even considering substantial future contributions of water conservation and wastewater reuse, new local water supply projects became increasingly difficult to identify for this area. This assessment process led to an extrapolation of the Board's forecasts to a 50 to 100-year period using low demographic/economic growth rates for the forecast and even higher levels of conservation and reuse potential. While tenuous assumptions underlie such a long-term forecast, this assessment indicated severe future water supply problems for approximately 1/3 of Texas, starting in the Houston metropolitan area and extending from approximately the Colorado River Basin to the southern tip of the State.

Should these forecasts be reasonably correct, one possible State policy might be to limit or stop growth in these water-short areas. However, adequate water supplies is a necessary, but not sufficient condition for growth. Economic and associated demographic growth occur for a variety of reasons, only one of which is the presence of adequate water supplies. Presence of other natural resources, trade corridors, transportation and other infrastructure, skilled labor forces, and other factors can stimulate growth and provide sufficient regional wealth to allow more expensive sources of water to be developed and imported to the these needy, growing areas.

Operating under the assumption that legislatively-induced significant constraints to growth will not occur for such a huge portion of our State, as well as the TWDB's own charge in the Texas Water Code to plan for sufficient water to be available at a reasonable cost to further the economic development of the *entire* State, Board staff has reinitiated studies of sharing inter-basin water resources, either through physical transfers or marketing and transfers of water from water-rich areas of Texas to regions in need. This is not a new idea and has been discussed in previous State water plans, although the time has arrived where current and upcoming needs in several large metropolitan areas warrant a serious and more detailed re-study of potentially feasible options such that decision-making and action can occur in a reasonable time in advance of severe problems manifesting themselves. In addition, this assessment will also examine whether innovative demand and supply management techniques or new local reservoirs are the best way to meet these area water demands compared to maximizing use of less proximate, but perhaps

economical and potentially less environmentally impacting, existing supplies through more innovative inter-basin management of regional supplies and/or the construction of new conveyance facilities. Ultimately, both economic and environmental feasibility of various structural or non-structural approaches will determine the pattern of future supply decisions for this southern region of the State.

Currently, the study concepts for the "Trans-Texas Water Program" involve an examination of providing additional water supplies to the Houston metropolitan area and potentially areas further south along the coast (termed the Trans-Texas Southeast Study) and another option of routing water supplies or transfers to more inland locations and eventually to urban demand centers such as San Antonio and Corpus Christi (termed the Trans-Texas South Central Study) or various combinations of the two. Different versions (sizings, routings, systems operations considerations, etc.) of these two major concepts would be assessed and compared to alternative means of satisfying area demands through local supply development projects or non-structural means. Environmental impacts and water needs would also be assessed. The overall study process would be supervised by a management council of the three State water agencies (TWDB, TWC, and TPWD) as well as with participation of potential local users of the water and other interest groups. A study scope is in the process of development with an anticipated overall study period of approximately three to four years.

## *4.2 PROJECT ASSESSMENTS*

### *4.2.1 Applewhite Reservoir*

Construction on the project was stopped due to a referendum election in San Antonio in 1991. Subsequently, the City Council passed an ordinance that no action will be taken on the construction of Applewhite until the issue is put to the voters for approval or rejection. The Southern Edwards Aquifer, however, may be placed under regulation that may limit the amount of ground-water available to less than what was estimated to be available in the Water Plan. If this happens, San Antonio will need to secure additional water supplies. Applewhite could ultimately serve, if reinitiated by the City, as proximate terminal storage for any additional supplies developed or imported from other basins, as well as provide a supply from its own operation. The recommendation is that the City keep all water supply options open at this time, pending further study or regulatory action, including the Applewhite project, springflow augmentation, recharge options, and other major supply alternatives. Also see Southern Edwards Aquifer Region, Section 4.1.9 for more detail.

### *4.2.2 Bosque Reservoir and Lake Waco Reallocation Project*

The potential Bosque Reservoir (Bosque County) and the Lake Waco Reallocation (McClennan County) projects now have State water use permits and are attempting to obtain Section 404 permitting. The recommendation is that the Plan note that these projects have State permits.

### 4.2.3 Brazos River Chloride Control Project

Salt springs in the upper Brazos Basin discharge significant quantities of dissolved solids into tributaries of the Brazos River. This discharge reduces the downstream water quality and the availability of water supplies in the Basin. The Corps of Engineers has conducted several large-scale studies of the salt pollution problems in the Basin and has recommended the construction of three chloride control projects: Croton, Dove, and Kiowa Peak in King, Stonewall, and Kent counties. The Corps has also evaluated a large-scale system of saline-groundwater recovery wells and deep well injection disposal of the salts. The Texas Water Development Board and Corps are currently funding further evaluation of the feasibility of controlling the discharge of brine into Salt Croton Creek in the Dove Creek area of King and Stonewall counties. Salt Croton Creek provides about 48% of the daily chloride load of the Brazos River. This overall study will include a technical and economic feasibility analysis. No change is required in the Plan recommendation at this time.

### 4.2.4 Canadian River Chloride Control Project

At this time, the project is waiting on authorization to allow Federal funding of the project, primarily to address sources of salt pollution originating in New Mexico. Authorization is hoped for within the year. If the funding is authorized, then the project would still have to go through the Federal budgeting process and have funds appropriated. The State of Texas has already authorized funding equal to any funds authorized by Congress, and the local sponsors will have to pay for any remaining cost. The State authorization will run out at the end of the current biennium.

In addition, studies funded (in part from the Research and Planning Grant program of the Texas Water Development Board) are presently underway to evaluate the potential of augmenting the Lake Meredith Reservoir supplies with higher quality ground-water supplies until such time as the water quality problems are reduced by the salinity control project. Also funded by TWDB is a study to evaluate other sources of salt pollution to the Canadian River. The studies should be completed within the next year. No change is required in the Plan recommendation at this time.

### 4.2.5 Cooper Reservoir

The Cooper Reservoir (Hopkins County), which will provide 48 mgd of additional water supplies to the North Texas Municipal Water District (NTMWD), 48 mgd to the City of Irving, and the remaining 24 mgd of supplies to other nearby communities, has completed construction and recently filled. The Upper Trinity Regional Water District has purchased 12 mgd of Cooper supplies from the City of Commerce on an interim basis. Construction of conveyance facilities to transport supplies to Lake Lavon are underway and should be complete by fall of 1994. Additional facilities to continue supplies to the City of Irving and the Upper Trinity Regional Water District are under investigation. The 1990 Water Plan should be amended to show this as a completed reservoir and a revised date for completion of the conveyance facilities.

### 4.2.6 Cuero Reservoir

The project area in DeWitt and Gonzales counties is being evaluated as critical habitat for a turtle that may be placed on the endangered species list. At the present time, the U.S. Fish and Wildlife Service is evaluating a request for a higher endangered classification of the turtle with the possibility of more mitigation requirements for the project site or permitting infeasibility. The recommendation is that there be no change in its Water Plan status, but note that the environmental evaluation is underway and could be resolved by the next update.

### 4.2.7 Eastex Reservoir

A regional planning study recommended that rural areas of Nacogdoches County use an alternative supply source (Lake Naconich) and that the City of Nacogdoches would have adequate supplies, assuming that the rural areas surrounding the City used supplies from the potential Lake Naconich. In subsequent information provided to the Board, the City of Nacogdoches has reaffirmed their participation and commitment to the Lake Eastex project. The City of Henderson has contracted for alternative supplies from the Sabine River Basin. However, the local sponsor for Lake Eastex has been approached by an power generation company expressing a near-term need for water and a willingness to participate in the reservoir project along with the cities of Nacogdoches, Jacksonville, and other area communities and water suppliers. Should the power company or other large user(s), sufficient to assure financial feasibility of the project, participate in the project in the near-term, the reservoir would be needed as soon as the year 2000. Should the power company or other substantial user(s) not participate in the near-term, the timing of need for the project could be delayed at least ten years until 2010.

### 4.2.8 Gilmer Reservoir

The City of Gilmer has obtained a State permit for the storage of 12,720 ac-ft and the use of 6,180 ac-ft/yr for municipal and industrial purposes. The City, at the present time, is developing information necessary for the Federal Section 404 permit application. The reservoir is intended for use only by the City of Gilmer and should replace the City's groundwater in any planning effort. The project should be noted in the Plan update.

### 4.2.9 Goliad Reservoir

Studies are underway to see which new surface water source would be the best to construct first, the Goliad project (located in Goliad and Karnes counties) or the nearby Lindenau project, as well as studies to look at the feasibility of diversions from the San Antonio River into the potential Cibolo Reservoir (Wilson County) site. The recommendation is to show no change for the potential Goliad Reservoir status in the Water Plan at this time.

### 4.2.10 Ivie Reservoir Conveyance Systems

Since the 1990 Water Plan, the new Owen H. Ivie Reservoir has been completed and filled. Construction has commenced on the portions of the conveyance systems to San Angelo and Midland/Odessa. Completion of the line to San Angelo is anticipated by July, 1993. Completion of the line to the Midland/Odessa area is expected by 1995. The City of Abilene estimates that its water conveyance from the lake will not be needed until the year 2015 or beyond. The Plan update should reflect these revised conditions.

### 4.2.11 Lake O' the Pines Reservoir

The U.S. Army Corps of Engineers is presently studying the feasibility of reallocation of flood control storage to water supply in Lake O' the Pines reservoir, located in Harrison and adjacent counties. Changes in flood operations would potentially affect water resources in Texas and Louisiana. No change in the Plan is recommended at this time.

### 4.2.12 Lindenau Reservoir

Since 1990, new diversion modeling by Board staff and a revised pool elevation to 232 ft. mean sea level to avoid more valuable upland environmental habitat has resulted in a revised supply estimate for the Lindenau project to 107,000 ac-ft/yr. If springflows are guaranteed at 100 cubic feet per second (cfs) and 50 cfs at Comal and San Marcos Springs, respectively, recapture of these guaranteed springflows downriver at the Lindenau site (in DeWit and Gonzales counties) could increase its supply by an additional 100,000 ac-ft/yr.

### 4.2.13 Little Cypress Reservoir

The City of Kilgore has purchased supplies from the Sabine River Authority and thus would not likely be a participant in the Little Cypress project (located in Harrison, Upshur, and Gregg counties). This would reduce demands on the project by about 3,600 ac-ft/yr by the year 2040. Uncertainty in project participation by the cities of Longview and Shreveport have also slowed progress on project implementation. The State permit is scheduled for consideration for renewal by the TWC in the fall 1992. Board staff feel the project is needed to meet significant manufacturing water demands in the region, as well as to provide needed additional supplies for the City of Marshall and firm, higher-quality supplies for the City of Longview, which is dependent in part on lower quality, run-of-the-river supplies. The recommendation is to show no change in the Plan at this time.

### 4.2.14 Medina Reservoir

A new study by the U.S. Bureau of Reclamation has indicated that the Medina Reservoir (Medina and Bandera counties) could produce a firm annual yield of 29,000 ac-ft/yr in the vicinity of the dam. Downstream at the existing diversion structure, yield estimates have been reduced to zero as a result of channel losses into aquifer recharge. The recommendation is to revise the Plan to indicate the new 29,000 ac-ft/yr firm yield estimate.

### 4.2.15 Natural Dam Chloride Control Project

As discussed in the 1990 Plan, the existing Natural Dam Lake in the upper Colorado River Basin in 1986 released highly saline water when water went around the natural plug across Sulphur Draw and into the river system, causing noticeable impacts on water quality many miles downstream. Four years ago, the Colorado River Municipal Water District had the dam raised and reinforced to alleviate this problem. Since that time, a continuing rise of the lake level has initiated work on two relief reservoirs on Sulphur Draw above the lake to intercept some of the potential inflows to the Natural Dam Lake. Construction on these relief facilities should be completed by late fall of 1992. The recommendation is to show no change in the Plan as a result of this action.

### 4.2.16 Neches Chloride Control Project

The recommended Neches River chloride control project, located in the Jefferson and Orange counties area, should be considered in the Trans-Texas East study alternatives as an integral part of the Toledo Bend to Houston conveyance system. No change is required in the Plan at this time.

### 4.2.17 New Bonham Reservoir

At the present time, the North Texas Municipal Water District #1 (NTMWD#1), which serves the area in the northeast portion of the Dallas metroplex, is evaluating alternatives to constructing the New Bonham project, located in Fannin County. Sardis Reservoir, located in southeast Oklahoma on Jackfork Creek about three miles north of the town of Clayton, is being investigated as an alternative supply. The reservoir has a conservation capacity of 274,330 acre-feet. The bill giving the Oklahoma Water Resources Board authority to sell to NTMWD#1 has recently passed the Oklahoma Legislature. NTMWD#1 has established a time frame of January 1993 for completion of contract negotiations. The recommendation is to point out that NTMWD#1 has several options available, and at this time, make no revised Plan recommendation until recently-initiated feasibility studies and interstate contract negotiations are complete.

### 4.2.18 Palo Duro Reservoir

Since the 1990 Water Plan, the project in Hansford County has completed construction and has begun the process of filling. The Plan update should note the project completion.

### 4.2.19 Paluxy Reservoir

A recent State court case ruled that this project, located in Sommerville and Hood counties, may have to go through the water-use permitting process again, and the applicant is currently undecided on how to proceed. If the permit cannot be issued, alternative supply sources would have to be pursued. The current TWDB recommendation is to retain the project in the Water Plan, but note that the previously-issued permit has been remanded to the TWC for re-hearing.

### 4.2.20 Red River Chloride Control Project

Funding for portions of the Red River Chloride Project for work in the Crowell area is continuing. The project was targeted in the President's rescission list, but was removed by Congress. The FY93 Congressional appropriation request for $6 million to continue design work, and progress in project areas VI, VII, IX ,X, XIII, and XIV have been approved by Congressional subcommittees. No change in the Water Plan is recommended at this time.

### 4.2.21 Site A Channel Dam Reservoir

At the present time, more detailed environmental studies have been requested by the TWC. Additional evaluations of the prior water availability studies are being conducted. Recommendation is that the Plan show no change at this time for this project located adjacent to the City of Brownsville.

### 4.2.22 Tehuacana Reservoir and Trinity River Diversion

At the present time, the Board is funding a pilot project to study diversions of return flows from the Fort Worth area into Tarrant County Water Control and Improvement District #1's lower reservoirs. If this study indicates that diversions are not feasible, then the Tehuacana project, located in Freestone County, may have to be moved forward on the time schedule. If studies indicate that the diversions are feasible, the Tehuacana project may not be needed until later. The recommendation is that the Plan be revised to show the need for the Tehaucana project by 2040.

### 4.2.23 Texana Reservoir

After several years of study and negotiation, a program for environmental releases from the project, located in Jackson County, is pending approval by the Texas Water Commission. The proposed release schedule, if approved, would not noticeably affect the amount of water permitted for use from the project. With reference to project users, the Corpus Christi Port Authority has entered into a contract to secure up to 41,000 ac-ft/yr of supplies from Lake Texana to supplement the constrained supplies of the Coastal Bend area (see discussion under Area Assessments).

Approximately 9,000 acre-feet of the option is available to LNRA for use if needed. The option is conditioned on getting the necessary State and Federal permits. Upon enactment of this agreement, supplies in Lake Texana will essentially be committed to known users or reserved for local supply purposes. Construction of pipeline conveyance facilities to Corpus Christi is anticipated in the 1996 time frame, and the Plan should be revised to reflect this advanced construction date.

### 4.2.24 Toledo Bend/Houston Conveyance System

If the recommended chloride control project on the Trinity River cannot be constructed, then this could have the result of advancing the need for the Toledo Bend to Houston area conveyance by ten years tc the year 2010 to 2020 time frame.

### 4.2.25 Trinity River Chloride Project

The 1992 Update should note that the U.S. Army Corps of Engineers has resumed construction of the Wallisville project near Anahuac, Texas. The Federal project would act as a salt water barrier for the lower Trinity River. The previous 1990 Water Plan recommendation did not necessarily envision a permanent dam/reservoir-type structure, although the Wallisville project would perform this function. The Wallisville project is under consideration by the Texas Water Commission for renewal of the State construction permit. Additional environmental information on the project has been requested by the TWC of its staff. The feasibility and timing of the Trans-Texas project could affect the need for and timing of the Wallisville project and vice-versa.

## 5.0 GLOSSARY

| | |
|---|---|
| ac-ft | acre-feet (one acre-foot equals 325,851 gallons) |
| ANRA | Angelina & Neches River Authority |
| B&E | Bays and Estuaries |
| BMP(s) | Best Management Practice(s) |
| BOD | Biochemical Oxygen Demand |
| Board | Texas Water Development Board |
| BRA | Brazos River Authority |
| BuRec | Bureau of Reclamation (Federal) |
| CCC | Coastal Coordination Council |
| cfs | cubic feet per second |
| COG(s) | Council(s) of Government |
| Corps | Army Corps of Engineers (Federal) |
| CRWA | Canadian River Water Authority |
| CWA | Clean Water Act (Federal) |
| DFund | Texas Water Development Fund |
| DO | Dissolved Oxygen |
| DOE | Department of Energy (Federal) |
| DOI | Department of the Interior (Federal) |
| DRASTIC | an acronym reflecting the seven measurable parameters for hydrogeologic setting used in a ground-water pollution analysis methodology |
| EDAP | Economically Distressed Areas Program (also called the Colonias Program) |
| ETJ | Extraterritorial Jurisdiction |
| EPA | U.S. Environmental Protection Agency |
| FESWMS-2DH | Finite Element Surface Water Modeling System - Two Dimensional Model |
| FmHA | Farmers Home Administration (Federal) |
| FY | Fiscal Year |
| gal(s) | gallon(s) |
| GBRA | Guadalupe-Blanco River Authority |
| GIS | Geographic Information Systems |
| GLO | General Land Office of Texas |
| gpcd | gallons per capita daily |
| gpd | gallons per day |
| HB | House Bill (Texas Legislature) |
| IBWC | International Boundary and Water Commission |
| IH | Interstate Highway |
| LCRA | Lower Colorado River Authority |
| LNRA | Lavaca-Navidad River Authority |
| LNVA | Lower Neches Valley Authority |

| | |
|---|---|
| MAT | Macrohabitat Assessment Technique |
| mgd | million gallons per day |
| mgy | million gallons per year |
| mlt | mean low tide |
| MOA | Memorandum of Agreement |
| MOU | Memorandum of Understanding |
| msl | mean sea level |
| MUD | Municipal Utility District |
| NAFTA | North American Free Trade Agreement |
| NPDES | National Pollutant Discharge Elimination System |
| NPS | Nonpoint Source (pollution) |
| NRA | Nueces River Authority |
| RASA | Regional Aquifer System Analysis |
| RRA | Red River Authority |
| RRC | Railroad Commission of Texas |
| SARA | San Antonio River Authority |
| SB | Senate Bill (Texas Legislature) |
| SDWA | Safe Drinking Water Act (Federal) |
| SJRA | San Jacinto River Authority |
| SRA | Sabine River Authority |
| SRF | State Revolving Fund |
| TAC | Texas Administrative Code |
| TDA | Texas Department of Agriculture |
| TDH | Texas Department of Health |
| TIGER | Bureau of the Census GIS Mapping of Census Tract Boundaries and Other Features |
| TML | Texas Municipal League |
| TNRIS | Texas Natural Resources Information System |
| TORP | Texas Outdoor Recreation Plan |
| TPWD | Texas Parks and Wildlife Department |
| TRA | Trinity River Authority |
| TSS | Total Suspended Solids |
| TSSWCB | Texas State Soil and Water Conservation Board |
| TWC | Texas Water Commission |
| TWDB | Texas Water Development Board |
| UGRA | Upper Guadalupe Authority |
| USFWS | U.S. Fish and Wildlife Service (Federal) |
| USCE | U.S. Army Corps of Engineers (Federal) |
| USGS | U. S. Geological Survey (Federal) |
| UWCD | Underground Water Conservation District |
| WQS | Water Quality Standards |