TRANS–TEXAS WATER PROGRAM

SOUTHEAST AREA

Final Report

Phase II Report

April 22, 1998

Sabine River Authority of Texas
Lower Neches Valley Authority
San Jacinto River Authority
City of Houston
Brazos River Authority
Texas Water Development Board

Preface

This document is a product of the Trans–Texas Water Program: Southeast Area. The program's mission is to propose the best economically and environmentally beneficial methods to meet water needs in Texas for the long term. The program's three planning areas are the Southeast Area, which includes the Houston-Galveston metropolitan area, the South-Central Area (including Corpus Christi), North-Central Area (including Austin) and the West-Central Area (including San Antonio).

The Southeast Area of the Trans–Texas Water Program draws perspectives from many organizations and citizens. The Policy Management Committee and its Southeast Area subcommittee guide the program; the Southeast Area Technical Advisory Committee serves as program advisor. Local sponsors are the Sabine River Authority of Texas, the Lower Neches Valley Authority, the San Jacinto River Authority, the City of Houston and the Brazos River Authority.

The Texas Water Development Board is the lead Texas agency for the Trans–Texas Water Program. The Board, along with the Texas Natural Resource Conservation Commission, the Texas Parks & Wildlife Department and the Texas General Land Office, set goals and policies for the program pertaining to water resources management and are members of the Policy Management Committee.

This is the final version of this document.

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Executive Summary

The Trans-Texas Water Program (TTWP) began with the idea that long-range water supply planning could be more efficient and effective if approached from a regional, multi-basin perspective. Water requirements and water supply sources do not recognize political boundaries and, to meet the challenge of providing adequate fresh water for tomorrow's communities, local resource planners need new strategies. The State of Texas is charged with providing a state water plan updated each two years. The Texas Water Development Board, charged with preparing this plan, saw the merit in the regional approach and, in 1993, sponsored the TTWP. TTWP is a coordinated study of the fifty – year water requirements and supply alternatives for approximately one-third of the state's current population. This document reports on the TTWP efforts undertaken by the Southeast Area, one of four study areas participating in TTWP.

Over the course of the program the Southeast Area determined its long range water requirements, the long-range water availability for the area and the issues affecting decision-making in the region. It also investigated 13 different water management strategies for their potential contribution to satisfying the future water requirements of the Southeast Area. The program concluded:

- There is adequate surface and groundwater within the Southeast Area to meet all TTWP demands, both Southeast Area and those of Central Texas.
- There is a geographic disparity between water resource supply centers and demand centers.
- Water supply shortages are predicted for different geographic areas of the TTWP area at different times over the program horizon. Areas of greatest population growth, specifically the Houston Metro area, are predicted to experience shortages by 2030 if no new water sources are developed.
- Water conservation, wastewater reclamation and systems operations techniques can extend the period of adequate supply and delay the need for new resources development in the Houston Metro area for 15 – 20 years.
- Other strategies, such as the Neches Salt Water Barrier, create additional supplies from existing resources.
- The development of Allens Creek Reservoir can provide a new supply source for the western side of the Southeast Area.
- Contractual Transfers of some existing supplies can be arranged which will result in additional reduced water availability and reduced conveyance requirements for certain regions. A projection of reduced irrigation demand throughout the Southeast study area offers an opportunity for contractual transfer of significant dependable surface water supplies to municipal and manufacturing areas.
- Interbasin transfer is currently used to meet Southeast Area water demands and will continue to be needed to meet the future water requirements of both the

Southeast and Central Texas areas. Several of the alternative strategies investigated require the use of interbasin transfers.

- Desalination, a viable alternative under some conditions, is not an economic or environmentally appropriate strategy for use in the Southeast Area.

There were many issues addressed in TTWP Southeast Area activities with regard to meeting the long-range water needs of the Southeast Area. These include:

- Public access to the decision-making processes.
- Methods of projecting population and water demands.
- Environmental criteria to be used when evaluating impacts to streams, bays and estuaries, and wetlands.
- Economic impacts associated with water supply decisions.
- Equity arrangements between exporting and importing basins and the representation of "third party interests" in these arrangements.
- Mechanisms for establishing regional goals and regional decision-making processes and undertaking regional programs.

The Omnibus Water Bill, Senate Bill 1 enacted in 1997 Texas State Legislature, has made regional water management planning the law. The TTWP experience in regional planning has placed the Southeast Area on track in moving toward SB 1 planning requirements. The TTWP Southeast Area sponsors begin the process with:

- Detailed planning data including population and water demand projections and water resource data evaluated by basin, county and water use type.
- Technical studies on local supply - and demand – side water management strategies and the impacts associated with their use.
- A broad understanding of local water related issues including those of environmental, social and economic interests.
- New methods of involving the public in decision-making processes and an awareness of third-party interests in the Southeast Area.
- Needed environmental research on the Sabine Lake and Galveston Bay systems and a better understanding of the potential impacts of various water use regimens.
- Partnerships with various water management stake-holders in Texas and Louisiana.

Much work remains to be done, but the TTWP Southeast Area project should provide a solid foundation for future water supply planning throughout the region.

1. Introduction

The 1990 Texas Water Plan determined that while there are adequate water supplies to meet the projected fifty-year demand for the State of Texas, a geographic disparity exists between areas with available water supply and projected demand. The eastern part of the state has an abundance of water, far in excess of projected local demands. Some western and coastal regions of the state are projected to experience shortfalls in water supply before the year 2020. The need to correct this imbalance and provide for the water needs of all Texas communities in a cost-effective and environmentally sensitive way provided the impetus for the Trans-Texas Water Program (TTWP).

The TTWP recognizes the regional nature of water supply/demand issues and was created to develop sound regional water management strategies for areas of Southeast, South-Central and West-Central Texas through 2050. Rapid growth in these regions' core urban cities of Houston, San Antonio, Austin and Corpus Christi has increased the need to investigate short and long-term water supply strategies. Historically, whenever an area had difficulty meeting increased demands from existing supply, it would unilaterally develop new supply sources, typically either ground water well fields or surface water reservoirs. Today, water planners face a very different situation. Environmental issues and cost considerations demand a new approach.

The 1997 Texas Legislature adopted Senate Bill 1 (SB1) which mandates additional regional water planning for the entire state. The Year 2000 State Water Plan will incorporate the water management plans developed by each of 16 regions of the state. Under the legislation a public body representing local government, water providers, industry, community and environmental interests will guide each regional master planning effort. Each region will develop a plan for meeting its projected fifty-year water demand while recognizing unique regional, environmental and equity issues. SB1 reflects an understanding of the current standard of water resource planning and is a logical progression from the efforts begun in the TTWP.

The TTWP, and now SB1, acknowledge the wide range of water needs; human and environmental; urban, rural, and agricultural; industrial and commercial; residential and recreational. This increased awareness causes pressure on existing water supplies. The City of Houston uses groundwater to meet a large portion of its local demand. Land subsidence, resulting from the removal of groundwater, requires the city to develop alternate water supplies for current and projected water demands. San Antonio has also depended upon groundwater from the Edwards Aquifer to meet local needs. Federal court rulings in 1993 require that pumping from the Edwards be sharply reduced to protect endangered species. San Antonio must also find alternative water supplies to meet future demands. For differing reasons, similar situations exist in Austin, Corpus Christi and other major cities in the state.

These Texas cities must concentrate on making effective use of existing supply through better water conservation practices, expanded reclamation and reuse, and more efficient operation of multiple-source systems. They must also look to new strategies

and approaches to matching existing supplies with current and projected demands.

These Texas cities must concentrate on making effective use of existing supply through better water conservation practices, expanded reclamation and reuse and more efficient operation of multiple-source systems. They must also look to new strategies and approaches to matching existing supplies with current and projected demands.

The TTWP began this process under the leadership of the mayors of Houston, San Antonio and Corpus Christi in 1992. They initiated a coordinated planning process to identify projected water needs and available water supplies and to attempt to balance supply and demand in a cost-effective and environmental responsible manner. The Texas Water Development Board (TWDB) recognized the value of this concept and agreed to sponsor further investigations through what became the TTWP. The mission and approach of the state-wide TTWP is shown in Figure 1.1.

It should be noted that in the TTWP the responsibility still rested with local communities to plan and implement water supply and management programs as necessary to meet their individual local needs. The TTWP represents a regional framework within which the local management programs could be formulated and coordinated; regional planning guiding local action. Initially three study areas were created: the Southeast, including the Houston metropolitan area as the primary demand center; the South-Central, with Corpus Christi as primary demand center; and the West-Central, with San Antonio as primary demand center. A North-Central study area, with Austin as the primary demand center, was identified later and added to the program. This report summarizes the technical study and planning efforts undertaken by the Southeast Study Area.

1.1 TTWP Goals and Objectives

Figure 1.2 illustrates both the statewide program goals and the Southeast Area's program objectives. Phase I objectives assumed the necessity of large-scale water transfers in the near or mid term to meet Southeast Area supply shortfalls. Revised planning data indicate that transfers will not be required to meet Southeast Area demand before the end of the planning period, approximately 2045. There will still be a need to develop additional local supplies and to provide additional supply for other TTWP areas within the 2000 - 2050 time frame.

Mission Statement: To determine the best method of providing for the short and long term (50-year) supplies of water to meet Texas' needs in a cost-effective and environmentally sensitive manner.

Approach: A cooperative effort of local, regional, and State of Texas water resources agencies and suppliers to manage the state's water resources to meet projected needs in the southeast, south-central and west-central areas.

Figure 1.1: Trans-Texas Water Program Mission and Approach

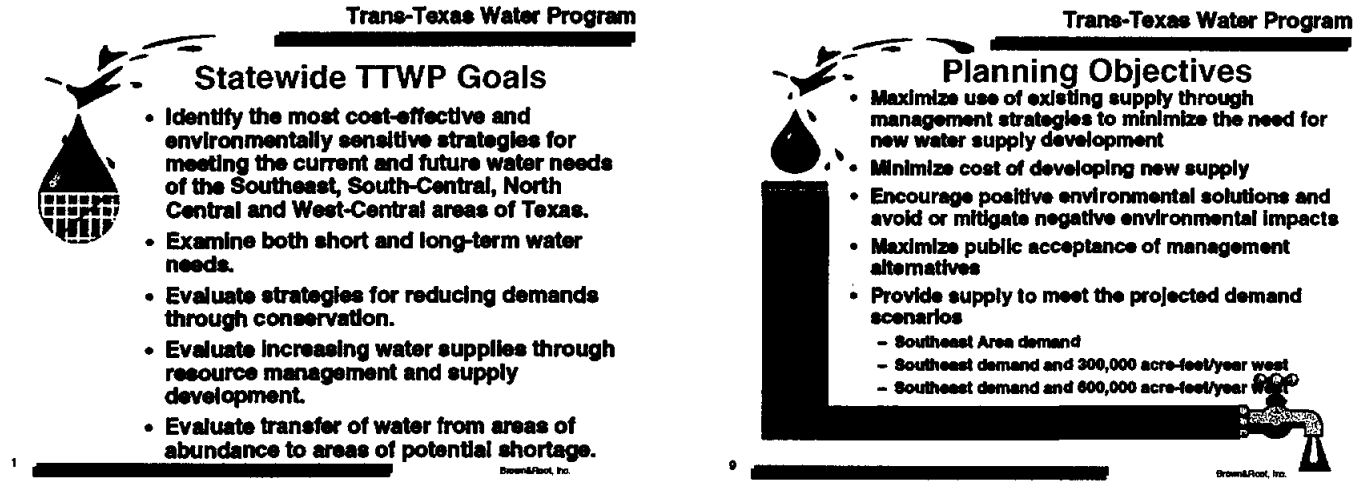


Figure 1.2: Trans-Texas Water Program Goals and Objectives

1.2 *Phase II Report* Purpose and Organization

This *Phase II Report* completes the Southeast Study Area's Trans-Texas Water

Program. It summarizes all planning and technical memoranda prepared within the TTWP Southeast Study Area program. It documents the results of all TTWP studies and their importance to the regional water management planning mandated through SB1.

Phase II efforts were directed by the initial Phase I recommendations and modified by the changing needs of water management planning in the state. Planning and technical analysis memoranda document the methodology of each study, present the study findings and analyze the impact of each on water management for the Southeast Study Area.

The planning memoranda define the parameters of water supply and demand for the region as well as investigate other issues or conditions that may affect water management in the region. Members of advisory committees received a copy of each memorandum. These memoranda include:

- Enhanced Public Participation (August, 1995)
- Planning Information Update (September, 1996)
- Phase II Program Update (September, 1996)
- The Sabine Lake Conference (September, 1996)
- Projected Water Needs and Supply of the Upper Neches and Sabine River Basins (September, 1997)
- Equity Issues Related to Water Transfers (January, 1998)
- Galveston Bay Freshwater Inflow Study (March, 1998)
- Impact of Potential Toledo Bend Operational Changes (January, 1998)
- Sabine Lake Salinity Analysis (April, 1998)

Technical Memoranda report on the investigations of recommended water management strategies identified in the *Phase I Report*. These include:

- Allens Creek Reservoir Studies: Status of Environmental Issues; Operations Studies and Opinions of Cost, Vol. I and II (April, 1997)
- Water Conservation (January, 1998)
- System Operation of Surface Water Supply Sources in the Houston Area (January, 1998)
- Wastewater Reclamation and Reuse (March, 1998)
- Environmental Analysis for the Neches Salt Water Barrier (February, 1998)
- Desalination (February, 1998)
- Environmental Analysis of Potential Transfer Routes, Screening Report (February, 1998)
- Engineering Analysis of Potential Transfer Routes, Screening Report (March, 1998)
- Contractual Transfers Analysis (March, 1998).

Finally, the *Phase II Report* compiles information from each of the water management alternatives for their potential contribution to the Southeast Area's future water supply. The products of the TTWP Phase II efforts provide valuable information and insight to the Senate Bill 1 planning bodies as they begin the work of regional water management planning. This report identifies issues of regional importance and topics that require additional research under SB1 regional planning.

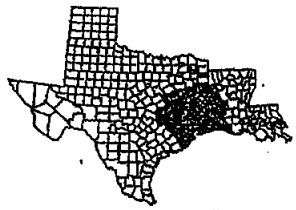
1.3 TTWP Background

The TTWP is divided into four study areas: the Southeast, South-Central, North-Central and West-Central. The TTWP is the foundation of an integrated regional water resource system and an important element in the 1996 Texas Water Plan. Technical evaluations completed in the TTWP provide valuable base data for the new SB1 regional planning efforts. The TTWP Southeast Area is located in the southeastern corner of the state, and comprises an area from the Sabine River on the Louisiana border west to the Brazos River basin. It includes 32 counties, all or part of eight river and coastal basins, and the Houston/Galveston and Golden Triangle metropolitan and industrial areas. The region encompasses about one-fourth of the state's population and one fifth of the state's total water demands. Figure 1.3 is a map of the 32-county region defined as the Southeast Area of the TTWP.

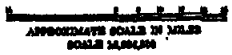
1.4 Program Organization

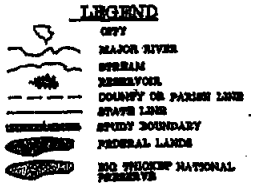
The Policy Management Committee (PMC) which establishes planning parameters and guidelines for all studies and provides coordination between the four study areas determines TTWP policy. The PMC also reviews all program deliverables and serves as a decision-making body regarding program recommendations. As shown in Figure 1.4, the PMC consists of the primary water resource planning and regulatory agencies for the State of Texas and major surface water supply entities.

Technical Advisory Committees (TACs) were established for each study area. These groups provide a forum for involvement and input by parties interested in or potentially affected by the TTWP. Appendix B includes a list of Southeast Study Area TAC members representing over 75 civic, environmental, industrial and recreational interests.



LOCATION MAP





SOUTHEAST
STUDY AREA

Figure 1.3

1.5 Public Involvement in TTWP

Public access was built into every level of the TTWP. Program sponsors organized the TTWP to encourage widespread dissemination of the program's progress. In the Southeast Study Area both the PMC and TAC serve as vehicles for public and agency involvement. During Phase I of the program there were three statewide PMC meetings, two Southeast PMC meetings and one Southeast TAC meeting.

Public involvement increased greatly during Phase II. The Southeast PMC, recognizing the importance of public involvement to the success of the TTWP, began Phase II with an investigation of ways to increase local involvement. The *Enhanced Public Participation Memorandum* (August, 1995) identified local issues and recommended methods to improve public involvement in the TTWP. The TAC was expanded from 50 to over 75 agencies, organizations and individuals. Topic specific focus groups (Planning Information, Water Resource Management and Environmental), were created to discuss issues of interest to specific sub-sets of the TAC. Notice of all PMC and TAC meetings expanded and meeting times and locations varied to permit greater participation.

Public meetings held during Phase II included:

- 8 statewide PMC,
- 11 Southeast PMC,
- 5 Southeast TAC. and
- 12 focus group or other public meetings.

A major symposium on the Sabine Lake was also sponsored by the TTWP. Preceding each meeting, notices and reports or support materials were sent to each committee member. In addition, the Southeast Study Area mailing list was added to the TWDB distribution of its quarterly TTWP newsletter. A list of each Phase II meeting held in the Southeast Study Area is included in Appendix C.

1.6 TTWP Southeast Area: Phase I

Phase I of the Southeast Area program, Project Initiation and Conceptual Planning, undertook preliminary analysis of projected water demand and estimated water supply for a fifty year planning period from 2000 through 2050. It concluded with the outline of a conceptual water management plan for the Southeast Area. This initial work indicated the potential for significant water shortages in some areas of the region, principally in areas served by the City of Houston, as early as year 2020. Phase I proposed an integrated water management program for the region that included a range of water management techniques designed to provide short and long term water supply for the entire Southeast Area and possibly for the demands of other Trans–Texas Water Program areas.

- The results of this initial analysis are presented in the *Trans–Texas Water Program, Southeast Area, Phase I Report* completed in March 1994. This document identifies existing Southeast Area water supplies, water demand projections, water ownership, and potential future water management options and opportunities. Based on this information, the *Phase I Report* lists five principal conclusions:
- "Sufficient water supplies currently exist within the Southeast Area to meet the projected demands within that area through approximately the year 2050 if ground water development occurs as pre-

dicted by the Texas Water Development Board (TWDB).

- "Much of the available water supply is not located in the areas of demand and will require major water transfers to achieve the needed balance.
- "Sufficient supplies do not currently exist within the Southeast Area to enable the Trans–Texas Water Program as a whole to meet all of the potential transfer requirements of the three study areas through 2050.
- "Feasible water management methods are available to hold the Southeast Area demands within reasonable levels, extend the use of water sources that already exist, and create new supply.
- "Effective application of the full scope of such methods in the Southeast Area should allow the Trans–Texas Water Program to satisfy the projected demands and interbasin transfer requirements of the entire region through 2050."[1]

The *Phase I Southeast Area Report* observes that within the Southeast Area's eight watershed basins, three basins (Sabine, Neches, Trinity) have supply surpluses in year 2050 while the other five basins show supply deficits. The total Southeast Area had a supply deficit of approximately 90,000 acre-feet per year in year 2050. All four TTWP program areas collectively are shown to need over 900,000 acre-feet of water per year by year 2050.

Potentially viable water management methods addressing these problems are identified and included in the Phase I conceptual water management plan. These management techniques include:

- Water conservation;
- Wastewater reclamation;
- Existing reservoir surplus supply use;
- Coordinated reservoir system operation;
- Interbasin transfers;
- Contractual transfers.

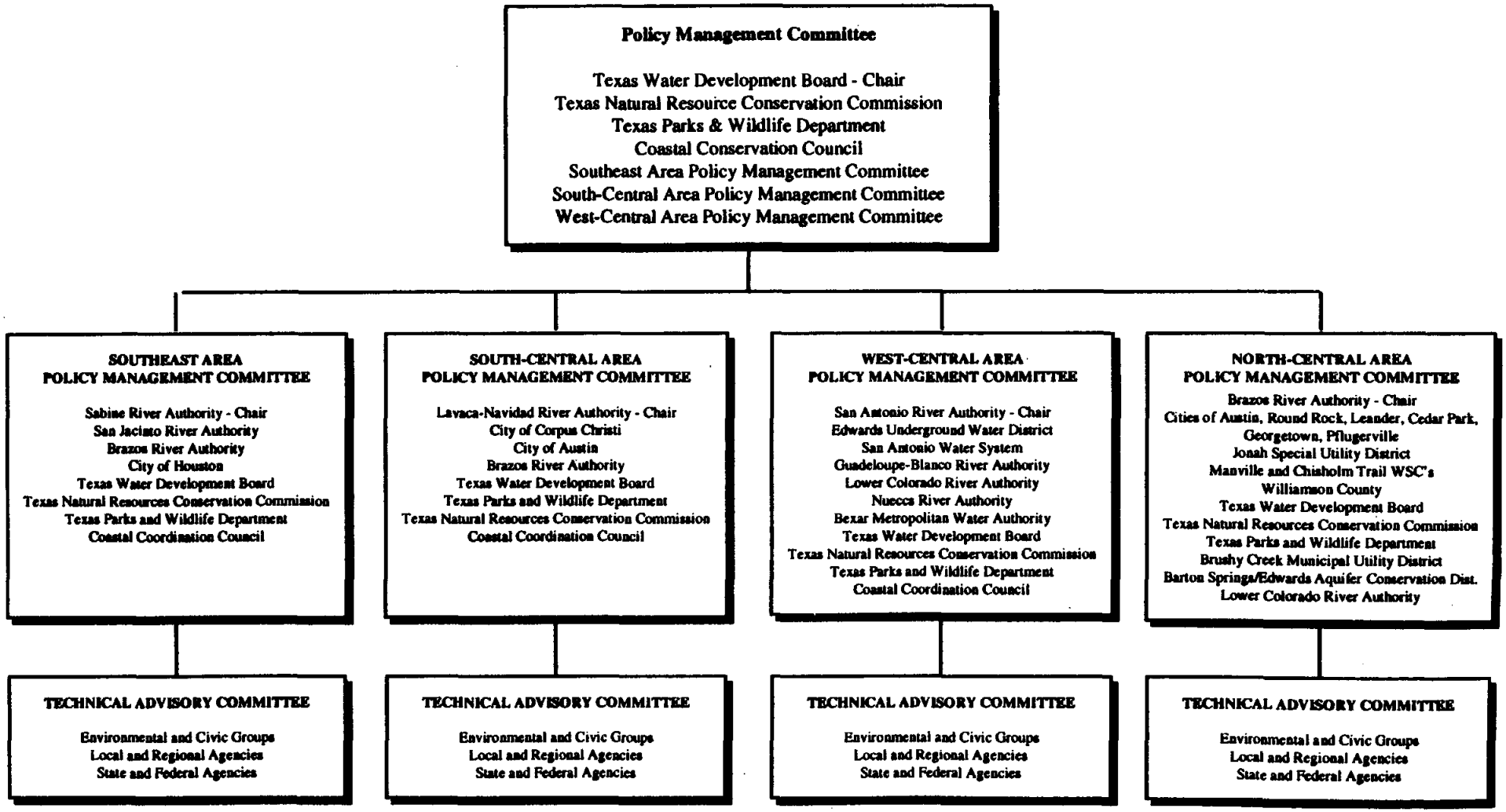
The initial water management analyses conclude that, while the application of many resource management techniques could satisfy this level of shortfall, no single management method could address these demands alone. Further, some of the management techniques must be used in combination. For example, several of these techniques rely on interbasin conveyance to function.

The *Southeast Area Phase I Report* concludes that an imbalance of supply and demand exists within the Southeast study area and that a suite of water resource management techniques should be employed to address projected water supply shortfalls. It also identifies interbasin transfer as key to addressing this imbalance because interbasin transfer can convey existing supply surpluses to areas of demand without the environmental and economic costs associated with the construction of new reservoirs and other additional supply sources. The *Phase I Report* also concludes that Sabine and Neches river waters are needed to meet the demand shortfall because these basins contain the largest sources of uncommitted surplus supply.

1.7 TTWP Southeast Area Phase II

- The initial Phase II goal was the development an implementable water management plan for the Southeast Area.

Figure 1.4
TTWP Committee Structure



This changed with the adoption of SB1. The new Phase II goal is providing SB1 planners with solid technical evaluation of the water management alternatives identified as potential strategies for the Southeast Area.

The following sections of this report summarize the finding of each study undertaken in Phase II. These reports satisfy this goal by providing data and technical guidance on water management issues for the Southeast Area.

2. Planning Memoranda

There are a total of six planning reports prepared during Phase II of the TTWP Southeast Area. Each of these reports investigates either demand or supply parameters associated with water resource management for the study area. Defining the size of demand in various water demand centers and for specific water uses across the planning horizon (1990 through 2050), determines the amount, type and location of water supply necessary to meet community needs.

The following sections will summarize the findings of each report and then evaluate these findings for their importance to short and long range water supply planning for the study area.

2.1 Planning Information Update Report

Decisions regarding future water management strategies, and ultimately system facilities, are based on projected future population and water demand. Phase II utilized the 1994 Consensus Water Planning projections for population and water demand through the year 2050. These data replaced previous projections developed by the TWDB in 1992 for the Texas Water Plan. The TWDB, TNRCC and TPWD developed the Consensus Water Planning projections in a cooperative process involving broad public review. The projections reflect significant procedural and technical modifications in methodology from previous data sets prepared by the state for planning purposes. In addition to the innovation of the consensus approach and increased interagency and public review, the methodology recognized the effects of generally lower population growth rates throughout the state in the early 1990s and the impact of increased conservation required under the 1991 State of Texas Plumbing Fixtures regulations on water demand.

The *Planning Information Update*[2] incorporates the revised data and updates the previous Phase I planning projections to reflect the projected population and water demand currently accepted by all state agencies. These data are included in *Water for Texas – Today and Tomorrow: A 1996 Consensus–Based Update to the Texas Water Plan. The* Southeast PMC adopted these data for all Phase II planning efforts. The primary conclusion of this memorandum follows.

2.1.1 Population

Projected populations for the Southeast Area were slightly increased, about 2 percent, for most of the study time periods. Populations in the San Jacinto, San Jacinto-Brazos, and Brazos basins, the high growth Houston Metro Region, are projected to grow at higher rates that previously expected. The Phase II 2050 population for the Houston Metro area increases by over three percent. Lower rates of growth are expected in the Sabine, Neches, Neches-Trinity and Trinity basins. Figure 2.1 illustrates the difference between Phase I and II population projections for the Southeast Area.

2.1.2 Water Requirements

While the Phase II populations are slightly increased over previous data sets, projected.

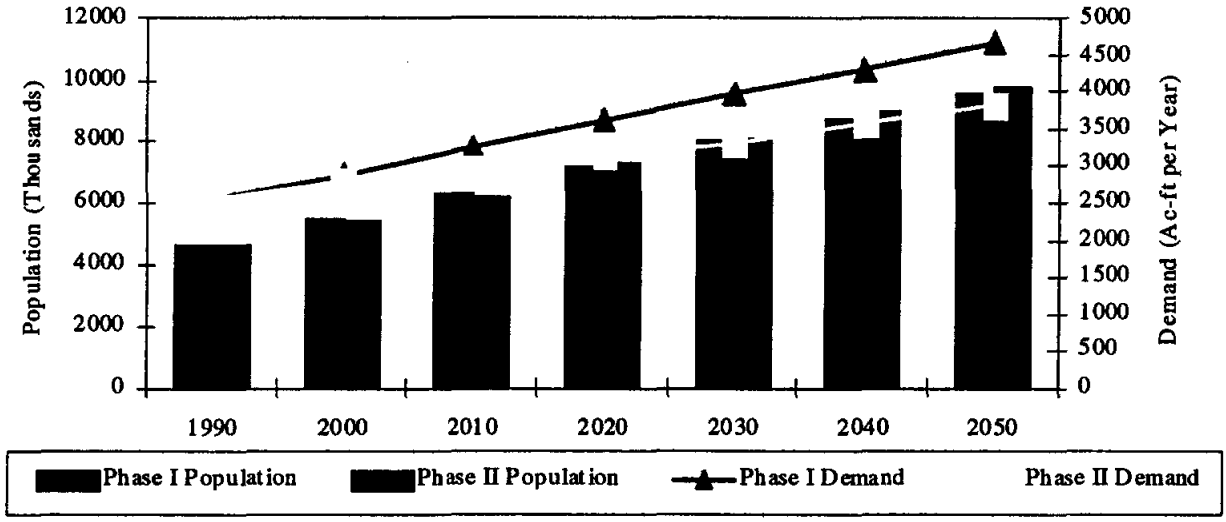


Figure 2.1: Population Projections and Water Demand for the Southeast Area

water requirements are reduced by 18 percent through the year 2050. The primary reason for the reduced projected demands is the application of different assumptions for municipal per capita water use and regional industrial growth. Additional reductions in demand result from water conservation savings and lower irrigation demands for the area in the future. See Figure 2.1.

2.1.3 Water Supply

Estimates of existing ground water and surface water in the Southeast Area are decreased by 82,100 acre-feet per year. This decrease is the result of revised 2050 groundwater estimates for Harris and Galveston counties indicating a decrease of 150,100 acre-feet per year. Projected surface water supply in 2050 is estimated to increase by 68,000 acre-feet per year, primarily as a result of larger available surface water supplies in the San Jacinto-Brazos the net decrease estimated for the area.

2.1.4 Impacts of Revised Data

These revised data indicate a different picture of the long-term water availability for the Southeast area.

- Revised water demands for the area indicate that current water supplies will be adequate to meet the regions needs for a longer period of time than previously expected.
- The eight-county Houston Metro Region, while requiring significantly less water than previously predicted, is the major demand center for the Southeast Area. The Metro Region will experience supply shortages by approximately 2030, twenty-five years later than Phase I projected. In spite of a regional surplus of water, localized shortages are expected to occur within the fifty-year planning period.
- There are substantial surplus surface water supplies throughout the 50-year planning period in the eastern basins, the Sabine, Neches, and Trinity River Basins. The Sabine Basin has surplus sup-

plies eight times larger than projected 2050 in-basin demand.

- After meeting all in-basin demands there remain adequate surplus water supplies in the southeast Area to meet all projected TTWP demand requirements. See Table 2.1, Southeast Area Water Supply Availability: 2000 – 2050 for detailed summary of both projected supply and demand by decade for each basin in the study area.
- As indicated in Table 2.2, even after meeting the highest export demand required for other TTWP areas, the Southeast Area continues to have an available supply surplus of 70,400 acre-feet per year.
- All conclusions regarding surplus supply in the Southeast Area precede a determination of the environmental need for water. The amount of water required for freshwater inflows to bays and to support riverine and wetlands environments has not yet been quantified. Any supply identified for the environment reduces the supply available for other uses in the study area.

2.2 Phase II Program Update

The *Phase II Program Update*[3] is a companion to the *Planning Information Update*. This report evaluates the impacts of the revised planning data upon the program objectives and the conclusions set forth in the original *Southeast Area Phase I Report*.

2.2.1 Reevaluation of Phase I Program Objectives

Phase I program objectives require reevaluation in the light of new planning data. A reduction of projected water demand and changes in estimated water supply shifted the timing for needed new supply and altered program objectives. The impacts of the revised planning data on Phase I program objectives are:

- The first TTWP objective, formulation of a water resource management plan to meet the entire TTWP region's short and long-term needs, remains a valid program effort. The second Phase I objective, use of interbasin transfer from Sabine and Neches River basins as the foundation of the TTWP to meet Southeast 2.2 Area water demands, is not currently valid. Interbasin transfers will continue to be needed both in the Southeast Area and elsewhere in the state but the large-scale transfer of Sabine and Neches River water may be unnecessary in the Southeast Area until the end of the planning period.
- While the Southeast Area has adequate supplies, the Houston Metro region will require a reallocation of existing water supplies to meet future demand. Current excess supplies exist within the Trinity River basin. These supplies must be conveyed into the northern San Jacinto and San Jacinto - Brazos River basins to meet future projected demands.
- Sufficient surplus supplies exist within the Sabine and Neches basins to meet projected in-basin water demands past year 2050 and also serve all of the West-Central supply shortfalls. As in the Southeast Area, revised demand projections for the West-Central area may further reduce those shortfalls.
- The transfer of Sabine and Neches surplus waters is no longer viewed as appropriate for the near term program. The importance of interbasin transfer of

Table 2-1: Southeast Area Water Supply Availability: 2000—2050

	Amount (Thousands of Acre-Feet/Year)								
Category	*Sabine*	*Neches*	*Neches-Trinity*	*Trinity*	*Trinity-San Jacinto*	*San Jacinto*	*San Jacinto-Brazos*	*Brazos*	*Total Southeast*
2000									
In-Basin Demands	86.0	261.4	329.9	138.5	143.2	949.7	464.2	427.3	2800.2
In-Basin Supplies									
Groundwater	23.3	110.5	7.5	34.3	26.6	451.7	74.9	130.5	859.3
Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	488.2	4197.6
TOTAL	1213.7	957.4	7.5	1390.7	26.6	709.4	132.7	618.7	5056.7
Surface Water Transfers									
Imported Supplies	0.9	1.4	322.4	0.0	116.6	300.3	331.5	0.0	1073.1
Export Demands	1.4	280.5	0.0	582.5	0.0	60.0	0.0	142.9	1073.1
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**844.3**	**207.8**	**0.0**	**669.7**	**0.0**	**0.0**	**0.0**	**42.7**	**1764.5**
2010									
In-Basin Demands	93.9	275.4	316.6	141.0	147.9	1,030.9	497.8	463.4	2966.9
In-Basin Supplies									
Groundwater	23.3	111.6	7.9	36.6	25.7	292.3	80.9	141.9	720.2
Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	487.6	4196.8
TOTAL	1213.7	958.5	7.9	1393.0	25.7	550.0	138.7	629.5	4917.0
Surface Water Transfers									
Imported Supplies	1.0	2.0	308.7	0.0	122.2	540.9	359.1	0.0	1333.9
Export Demands	2.0	279.5	0.0	839.2	0.0	60.0	0.0	153.2	1333.9
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**835.8**	**196.5**	**0.0**	**412.8**	**0.0**	**0.0**	**0.0**	**12.9**	**1458.1**
2020									
In-Basin Demands	102.4	287.3	304.4	144.0	152.6	1,128.7	529.7	492.7	3141.9
In-Basin Supplies									
Groundwater	23.3	112.8	8.3	38.7	31.1	251.1	87.1	156.1	708.5
Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	487.1	4196.3
TOTAL	1213.7	959.7	8.3	1395.1	31.1	508.8	144.9	643.2	4904.8
Surface Water Transfers									
Imported Supplies	1.0	2.6	296.1	0.0	121.5	679.9	384.8	0.0	1485.9
Export Demands	2.6	266.9	0.0	993.4	0.0	60.0	0.0	163.0	1485.9
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**826.7**	**199.0**	**0.0**	**257.7**	**0.0**	**0.0**	**0.0**	**-12.5**	**1271.0**

Table 2-1: Southeast Area Water Supply Availability: 2000 – 2050, Continued.

Amount (Thousands of Acre-Feet/Year)

Category	*Sabine*	*Neches*	*Neches -Trinity*	*Trinity*	*Trinity-San Jacinto*	*San Jacinto*	*San Jacinto -Brazos*	*Brazos*	*Total Southeast*
2030									
In-Basin Demands	111.0	299.4	303.1	148.1	156.9	1,201.4	567.7	529.1	3316.7
In-Basin Supplies									
Groundwater	23.4	114.6	8.7	41.2	27.9	266.3	87.8	169.4	739.3
Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	486.6	4195.8
TOTAL	1213.8	961.5	8.7	1397.6	27.9	524.0	145.6	656.0	4935.1
Surface Water Transfers									
Imported Supplies	1.0	4.1	294.4	0.0	129.0	726.2	422.1	0.0	1576.8
Export Demands	4.1	265.3	0.0	1072.6	0.0	60.0	0.0	174.7	1576.7
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**816.8**	**191.8**	**0.0**	**176.9**	**0.0**	**-11.2**	**0.0**	**-47.8**	**1126.5**
2040									
In-Basin Demands	123.1	321.7	306.7	159.3	167.0	1,298.3	617.9	583.2	3577.2
In-Basin Supplies									
Groundwater	23.5	116.3	8.8	43.8	29.6	280.5	88.8	181.1	772.4
Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	486.0	4195.2
TOTAL	1213.9	963.2	8.8	1400.2	29.6	538.2	146.6	667.1	4967.6
Surface Water Transfers									
Imported Supplies	1.0	4.6	297.7	0.0	123.5	710.9	460.8	0.0	1598.7
Export Demands	4.6	268.7	0.0	1075.3	0.0	60.0	0.0	190.1	1598.7
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**804.3**	**168.3**	**0.0**	**165.6**	**-13.9**	**-109.2**	**-10.5**	**-106.2**	**898.4**
2050									
In-Basin Demands	135.8	344.8	310.6	174.5	179.9	1,386.4	668.4	639.2	3839.6
In-Basin Supplies									
Groundwater	23.6	118.3	9.0	46.7	31.0	291.8	89.7	197.3	807.4
Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	485.4	4194.6
TOTAL	1214.0	965.2	9.0	1403.1	31.0	549.5	147.5	682.7	5002.0
Transfers									
Imported Supplies	1.1	5.1	301.6	0.0	123.5	710.9	476.3	0.0	1618.5
Export Demands	5.3	272.2	0.0	1075.4	0.0	60.0	0.0	205.6	1618.5
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**791.0**	**144.2**	**0.0**	**153.2**	**-25.4**	**-186.0**	**-44.6**	**-162.1**	**670.4**

Table 2-2: Trans-Texas Water Program Supply Availability: 2000-2050

Category	Amount (Thousands of Acre-Feet/Year) 2000	2010	2020	2030	2040	2050
Scenario 1						
Available Southeast Supply	1764.5	1458.1	1271	1126.5	898.4	670.4
West-Central Demand	-	-	150	300	450	600
Net Surface Water Availability	**1764.5**	**1458.1**	**1121**	**826.5**	**448.4**	**70.4**
Scenario 2						
Available Southeast Supply	1764.5	1458.1	1271	1126.5	898.4	670.4
West-Central Demand	-	-	-	100	200	300
Net Surface Water Availability	**1764.5**	**1458.1**	**1271**	**1026.5**	**698.4**	**370.4**
Scenario 3						
Available Southeast Supply	1764.5	1458.1	1271	1126.5	898.4	670.4
West-Central Demand	0	0	0	0	0	0
Net Surface Water Availability	**1764.5**	**1458.1**	**1271**	**1126.5**	**898.4**	**670.4**

existing supplies has diminished in terms of priority.

2.2.2 Phase II Program Modifications

The Phase II program was modified as a result of this evaluation. These modifications are:

- Reduced effort associated with the definition of conceptual interbasin transfer routes from Sabine and Neches River basins.
- Increased effort in defining water quality issues associated with Sabine Lake.
- Increased analysis of the socio-economic impacts of interbasin transfer on exporting and importing basins.

2.3 Public Issues Memoranda

Two memoranda report on investigations of public involvement issues; *Enhanced Public Participation*[4] and *Equity Issues Related to Water Transfers*[5]. Each of these describes the TTWP Southeast Area research into the program's public access and its responsiveness to public concerns. Very early in the TTWP process the Southeast Area sponsors

recognized that directly involving members of the public in the water planning process was necessary for program success. Early and meaningful citizen involvement may resolve major disputes and avoid future litigation. Phase II work began with an investigation of ways to broaden the initial public participation efforts on two fronts: by identifying individuals and groups who may not have been included in the TAC process, and by conducting one-on-one interviews with TAC members and others to ensure that issues were identified in time to be addressed within the TTWP study and planning process.

Enhanced Public Participation documents the conclusions drawn from over 70 personal interviews of project sponsors and representatives from local, state and federal government agencies, river authorities, environmental, recreation, civic and industry groups. The interviews sought information about perceptions, understanding and attitudes of the TTWP in general and the Southeast Area study specifically. A copy of the interview protocol and list of entities included in the interview process are included in Appendix D. The primary conclusions drawn from these interviews are as follows.

- Develop and disseminate public information about the TTWP and about the broad range of management alternative being considered.
- Provide better information regarding the population and water demand projections used in TTWP.
- Provide more information about the importance and impact of water conservation on water demand, specifically in the Houston Metro region.
- Investigate the complete range of impacts associated with interbasin transfers from the Sabine River basin including environmental, social and economic impacts and third party equity issues.
- Evaluate the impacts to the Sabine Lake and area wetlands from large-scale water transfers out of the basin.

TTWP addressed these issues in several ways.

- TAC membership was expanded with directed out-reach activities to interest groups that were not represented or under-represented. Representatives from Louisiana were invited to join the TAC.
- Convened the Sabine Lake Conference providing a forum for sharing of available scientific and other information among the academic community, technical staff of agencies and consultants, policy makers and the interested pubic.
- Focus groups and task forces met to provide substantive information and input to several areas of study including environmental impacts, equity issues and planning projections.
- Made additional TTWP presentations to interested groups and organizations.
- Expanded the distribution of planning and technical memoranda.
- Included in Phase II an examination of the equity issues associated with interbasin transfer.

The *Equity Issues Related to Water Transfers; Southeast Area* memorandum reports on this effort. The report examines equity issues related to a major transfer of water from the Sabine Basin. Two major types of issues were identified: environmental impacts and "our water" basin of origin con-

cerns. The basic approach recommended for accomplishing water transfers in the Southeast Area is informed negotiation with compensation and mitigation for impacts. The study recommendations are:

- The State of Texas take the lead in identifying and supporting a planning entity to undertake information gathering needed for decision-making in the Southeast Area.
- Following data collection, involved parties enter into negotiation seeking a solution that will recognize the full cost of a water transfer.

2.4 Projected Water Needs and Supply of the Upper Neches and Sabine River Basins

The TTWP Southeast Area includes only part of the Sabine and Neches River basins. Part or all of 21 counties are included in the upstream reaches of these two basins that lie outside of the program study area. Figure 2.2 illustrates the location of these counties relative to the TTWP Southeast Area. The populations of these counties rely upon the same river systems to meet water demands. These demands must be considered when determining the total demand for water within these basins and provided for when determining available supply in these basins.

Therefore, a detailed analysis of this issue was prepared and presented in *Projected Water Needs and Supply of the Upper Neches and Sabine River Basins*[6] in Phase II. The TWDB Consensus population and water requirement projections were used in this study. The report concluded that:

- All projected 2050 requirements in the Upper Neches Basin can be met with either existing sources or from the proposed Eastex project. There is no present indication that the future needs of the upper Neches area through the year 2050 will require water from the TTWP Southeast Area.
- The situation in the upper Sabine River Basin is more complex. Essentially all of the firm yields of the existing surface water reservoirs in the upper Sabine are already committed. A comparison of water requirements and available supply in the upper Sabine Basin in 2050 indicates a supply shortfall of at least 103,061 acre-feet per year. The shortages may be larger depending upon the location of demand and supply source within the basin.
- There are no new reservoir projects under development in the upper Sabine Basin and no water right has been granted for a major new reservoir in the area. Based on the consensus projections it is likely that the upper Sabine Basin could need to draw water from the Southeast Area over the study time horizon. The upper Sabine Basin total demand could be in the range of 100,000 to 200,000 acre-feet per year.

The report also notes:

- Projections of future population growth and water use area always uncertain. Any major development in the area could significantly alter population and water demand projections for the upper basin counties.
- There remains uncertainty in the amount of groundwater that can be developed in the upper basins. The report assumed that 1990 pumpage was a reasonable predictor of long-term dependable groundwater use.

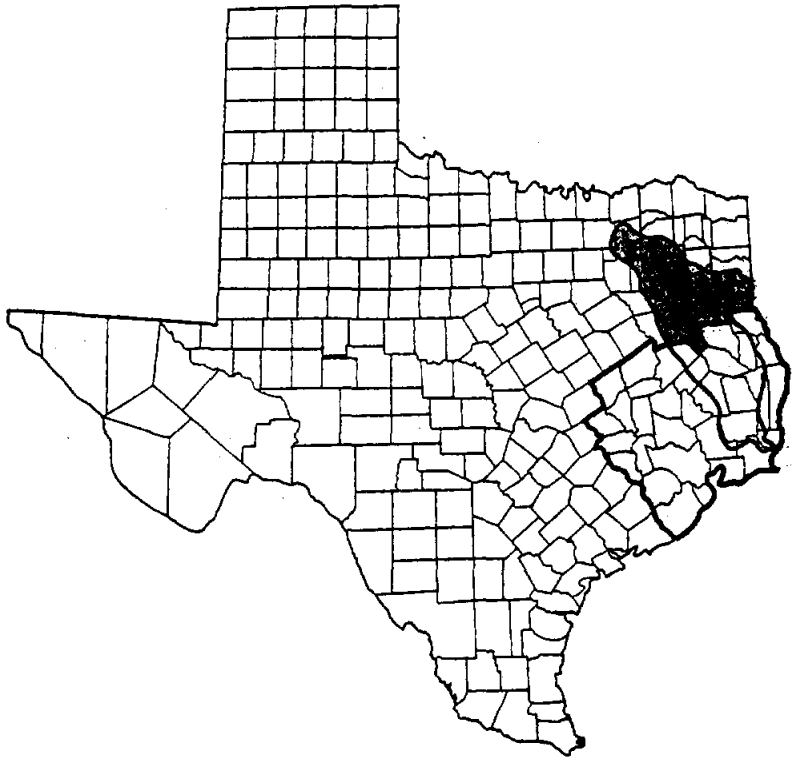


Figure 2.2: Upper Neches and Sabine River Basins

2.5 Sabine Lake Characterization

Initial investigation of environmental impacts of water transfers from the Sabine River Basin on the Sabine Lake system indicate a lack of base-line information on the environmental conditions of Sabine Lake and adjacent uplands and wetlands. TTWP undertook two activities to expand the knowledge about the lake and the potential impacts of large-scale transfer on the area's environment.

The Sabine Lake Conference: Where Texas and Louisiana Come Together[7] (September, 1996) assembled experts on the lake and surrounding uplands and wetlands from both Texas and Louisiana to share and document existing information. Presentations during the two-day conference provided an overview of the climatologic, geologic, hydrologic, ecologic and economic conditions associated with the lake as well as stewardship issues in both states.

The *Sabine Lake Salinity Analysis* looked at hydrodynamic and meteologic data collected from five water monitoring stations over a twelve-month period. The data were analyzed for flow and salinity patterns within Sabine Lake resulting from a reduction of freshwater inflows, using a two-dimensional hydrodynamic simulation model. This effort is continuing and final results will be available later in the year.

2.6 Galveston Bay Freshwater Inflows Assessment

The Galveston Bay Freshwater Inflows Group (GBFIG) began as a TTWP focus group of individuals concerned with main-

taining the health and productivity of Galveston Bay. The 33,000 square mile Galveston Bay watershed consists of the Trinity and San Jacinto River Basins and the Neches-Trinity, Trinity-San Jacinto, and San Jacinto-Brazos Coastal basins. The bay consists of four separate embayments; Galveston, Trinity, East and West Bays. The TWDB has studied the health and productivity of Galveston Bay over the past several years in the Galveston Bay and Estuary program (B&E Program), specifically with regard to the freshwater inflows into the bay to optimize annual fisheries harvests. The B&E Program analysis determined that 5,220,000 af/y were required to produce the optimum fishery harvest in the bay.

The Board presented its findings on recommended inflows to the bay in 1997 but the GBFIG determined that a number of additional water availability hydrologic investigations were necessary to analyze current and future projected inflows into the bay. The *Galveston Bay Freshwater Inflows Assessment*[8] technical memorandum documents the first of these studies, an investigation of freshwater inflows estimating inflows under naturalized, intermediate and full development inflow conditions. The study analyzes the statistical frequency of obtaining certain hydrologic flow conditions within the Galveston Bay watershed based on water rights diversions upstream of the bay.

A complex multi-river basin simulation model determined projected freshwater inflows. The naturalized flow scenario assumed no water rights diversions. The intermediate and full development condition scenarios assumed water usage diversions for intermediate use and maximum use of current permitted diversions respectively. Comparing the results of this modeling with the TWDB B&E Program modeling indicate the following.

- Increases in water rights diversions will continue to decrease the availability of freshwater inflows that enter Galveston Bay. Future projected diversions could decrease inflows by as much as 30 percent from historical naturalized flow conditions.
- The bay and estuary maximun harvest monthly inflow targets can be achieved in eight months of the year (January, February, April, July, August, September, October, and November) upon maximum use of existing water rights permits. Projected water rights diversions will not negatively impact the bay in these months.
- Maximum use of existing water rights permits are projected to reduce monthly inflow into the bay below the bay and estuary maximun harvest targets by approximately 12 percent in the months of March, May, June, and December. Additional hydrologic analysis should occur to determine the impact of these inflow reductions.
- The geographic distribution of inflows is projected to shift. In upper Trinity Bay flows will decrease. In Upper Galveston, East and West Bays flows will increase as compared to historical events.
- The studies indicate that total inflows quantity, monthly distribution, and geographic distribution will change. It was not analyzed which of these parameters may have the greatest impact on fisheries productivity.
- Projected worst-case inflow conditions should significantly improve suggesting that future drought condition inflows

may not be as low as has historically occurred due to increased return flows into the bay.

The GBFIG plans to continue to meet independent of TTWP to study other issues of concern with regard to the impacts of water resource development on Galveston Bay.

2.7 Impact of Potential Toledo Bend Operational Changes

TTWP investigated the potential impacts of changes in the operation of Toledo Bend Reservoir under various hydrologic conditions. Toledo Bend Reservoir was built to provide water supply for municipal, industrial and irrigation use and for generation of hydroelectric power. The total firm yield of the reservoir is estimated at 2,086,600 af/y. Under terms of an interstate agreement, the Toledo Bend Compact, Louisiana and Texas each own half of this supply (1,043,300 af/y each). The existing water rights of the Sabine River Authority of Texas provide for diversion and use of 750,000 af/y from Toledo Bend Reservoir. The present water rights in Texas leave some 293,300 af/y of the Texas firm yield unallocated.

This memorandum documents the investigation of the potential environmental significance of:

- increasing the permitted diversions for use in Texas from 750,000 to Texas' total firm yield share of 1,043,300 af/y;
- obtaining an interbasin transfer amendment and transferring 672,000 af/y (600 MGD) to areas west of the Sabine and Neches River Basins with no return flows to Sabine Lake.

Reservoir operation studies were made for two different fifty-year scenarios (1940 – 1989) at Toledo Bend. The first scenario examines impacts of full use of permitted supply. The second scenario examines a modified operating condition where the Texas use is increased to full use of its share of the firm yield (1,043,300 af/y) and an interbasin transfer of 672,000 af/y is transferred to areas from which there would be no return flows to the basin. Both scenarios assume greater use from Toledo Bend Reservoir than is now occurring. The analysis evaluates changes in the monthly lake levels, spills, inflows to Sabine Lake, Sabine River flows and recreation.

The study concludes that:

- Increased uses associated with full use of existing rights and export would lower Toledo Bend Reservoir levels an average of 0.9 foot and up to a maximum of 3.3 feet. There would be no noticeable decrease in lake levels one third of the time.
- 70 percent of the time there would be no change in spills. The other 30 percent of the time Toledo Bend Dam spills decrease, especially in February through May.
- Decreased flows to Sabine Lake range from 12.2 percent under the existing condition scenario to 20.7 percent under the modified condition scenario.
- Toledo Bend Reservoir tends to increase flows into Sabine Lake in summer months over natural flows.
- Toledo Bend Reservoir increases the shortages in the environmental flows specified in the TTWP environmental criteri, especially January through May, under all scenarios.
- Impacts on the Toledo Bend Reservoir or the lower Sabine River recreational

activities of fishing and boating are not significant.

- The modified scenario heavily influences the estimated losses of freshwater inflow to Sabine Lake.

Please refer to the memorandum *Impact of Potential Toledo Bend Operational Changes*[9], January 1998 for complete information.

3. Technical Memoranda

Ten technical memoranda report on the investigation of water management alternatives considered within the Phase II TTWP Southeast Area study. Each of these reports documents the analysis of one water management strategy recommended for further study in the *Phase I Report*. Each memoranda includes a discussion of the strategy involved, a discussion of its relative importance to the TTWP, a projected amount of supply produced or saved by this strategy, its costs, and impacts associated with the strategy's use. The following sections briefly summarize each memoranda and list the primary factors and conclusions reported. Copies of the full technical reports are available from project sponsors and are recommended for a more complete understanding of each alternative.

A comparison of each alternative and its relative contribution to the TTWP Southeast Area long-range water management planning is included in the next section of this report.

3.1 Water Conservation

Water conservation is a demand management strategy designed to manipulate water usage characteristics and facilitate more efficient use of existing water supplies. It does not create new supply but allows existing supply sources to serve demand for a longer period of time and delays the need to develop new supply options. The demand reduction associated with implementation of conservation practices is calculated as the volume of conservation "savings". These savings are then evaluated against the originally projected water demand defined for the area.

The TTWP Southeast Area water conservation effort, as reported in *Water Conservation,*[10] provides a means to communicate the City of Houston's *Water Conservation and Reservoir Systems Operation Plan*[11] effort throughout the Southeast Area. To that end the TTWP used the City plan as baseline data for this evaluation.

The study assesses the viability of an "advanced" degree of water conservation defined as the implementation of conservation measures sooner and in addition to the "expected" conservation already incorporated into TWDB demand projections. The assessment concludes:

- The total quantity of conservation savings directly attributable to the advanced conservation measures examined in the study varies from 23,880 af/y to a maximum level of 64,773 af/y. This represents savings of approximately 2.9 to 6.3 percent of the total projected Houston Metro water demand. See Figure 3.1 for a comparison of water demand under expected and advanced conservation scenarios.
- The impact of these conservation savings on total Southeast Area water availability is to allow existing area supplies to meet projected demands for an additional 10 years in the San Jacinto, Trinity-San Jacinto, and San Jacinto-Brazos Basins. Appendix E, Southeast Area Water Availability with Advanced Conservation Strategy 2000 – 2050, details these savings across the study time horizon and basins.

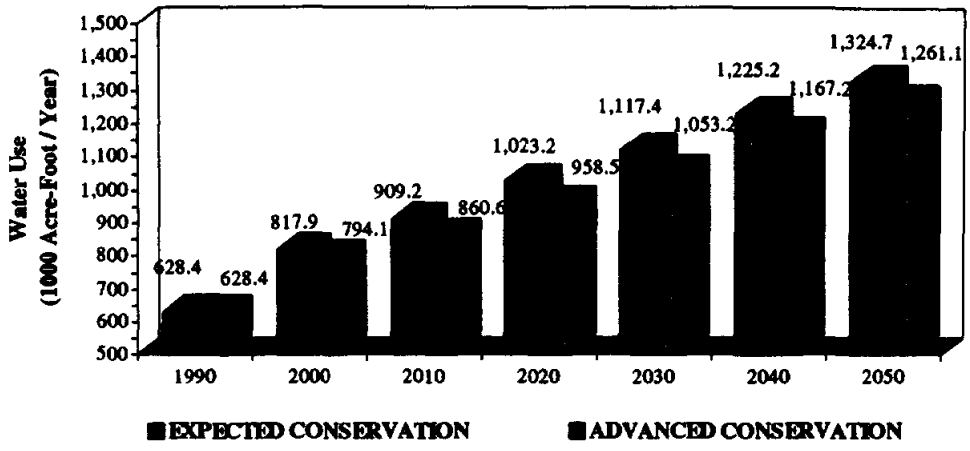


Figure 3.1: Comparison of Projected Municipal Water Demand with Conservation

Minimal environmental impacts are expected from the City of Houston's conservation activities. Construction-related impacts are limited to building interiors and existing urban streetscapes. Minor reductions in water quantity within the basin due to reduced return flows may occur. Consumers may experience short-term price increases to compensate the

- utility for loss of revenue from water sales. This minor impact (1.2 percent) is due to the positive impact of deferred capital cost expenditures needed for construction of additional water and wastewater treatment facilities. The cost of "saved" water is approximately $120 per acre-foot.

3.3 Desalination

The TTWP evaluated the potential desalination of brackish groundwater to provide additional supply in the high demand Harris, Fort Bend, Brazoria county area. Preliminary investigations, published in *Desalination,*[12] indicated that, for cost-effectiveness, the desalination strategy would be configured to address mid- to long-term demand shortfalls in the Trinity-San Jacinto, San Jacinto, San Jacinto-Brazos and Brazos basins. The analysis investigated developing a desalination facility that could contribute to the water supply in this area. The source supply for the facility would be a groundwater well field in Harris County withdrawing brackish water from the lower Evangeline and upper Jasper aquifers. A desalination plant utilizing a reverse osmosis (RO) process would extract dissolved solids from the groundwater to provide 44,600 af/y to southeastern Harris and northern Galveston counties. Brine concentrate effluent would be discharged directly into the Houston Ship Channel. See Figure 3.2.

Key findings of the analysis are:

- The desalination strategy can meet projected San Jacinto-Brazos basin demands through the year 2050 however, even when coupled with existing regional water supplies, projected water deficits will exist within the Houston region by 2020.
- Environmental impacts associated with a desalination strategy appear to be potentially significant. The additional salt concentrate disposal into the Houston Ship Channel may cause localized aquatic environmental impacts. Potential land subsidence impacts could also

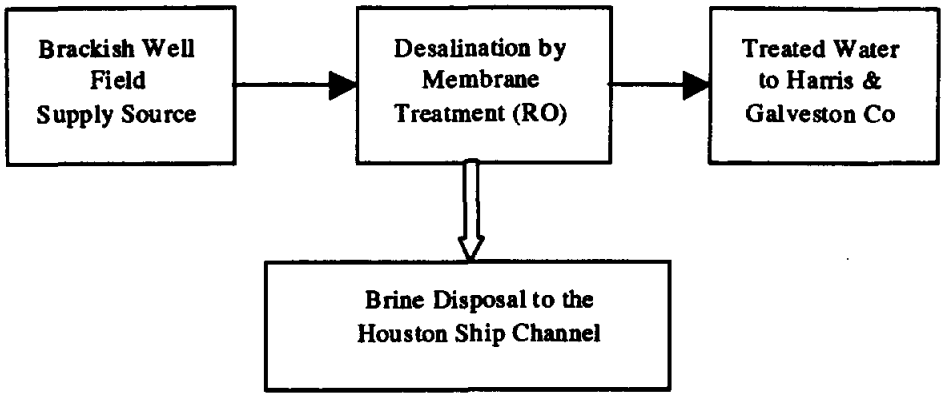


Figure 3.2: Desalination Process Diagram

eliminate this alternative from consideration.

Total capital costs of implementing the proposed desalination strategy are approximately $151 million. This is approximately $1,270 per acre-foot of supply.

3.4 Wastewater Reclamation

An investigation of Wastewater Reclamation as a strategy for Southeast Area TTWP examines the potential of meeting some of the Houston Metro region shortages through the use of reclaimed wastewater from the City of Houston's 69th Street, Sims Bayou North, and Sims Bayou South Waste Water Treatment Plants (WWTPs). A technical memorandum, *Wastewater Reclamation,*[13] documents the results of this study. The strategy consists of diverting effluent from these three city WWTPs, treating the wastewater to a quality acceptable to industrial customers for process and cooling water uses, and transmitting the treated wastewater to customers through the Coastal Water Authority's (CWA) industrial raw water distribution system.

The system proposed would be designed to meet the water demand of 9 industrial customers located along the existing CWA B1 line. The design criteria are configured to supply 100 percent of the demand 100 percent of the time. The proposed system transmits 95 million gallons per day (MGD) of wastewater from the three City of Houston WWTPs to a Wastewater Reclamation Plant (WRP). The WRP will employ a membrane (reverse osmosis) treatment process to remove all identified pollutants before flowing to the finished water pump station for distribution to industrial users through the CWA B-1 line. Brine concentrate, the process effluent, would be discharged into the Houston Ship Channel. See Figure 3.3.

The key findings of the analysis are:

- An 81-MGD capacity reclamation facility would provide approximately 90,700 af/y of water to meet future demands of approximately 9 industries along the CWA B-1 line in the Houston Metro area.

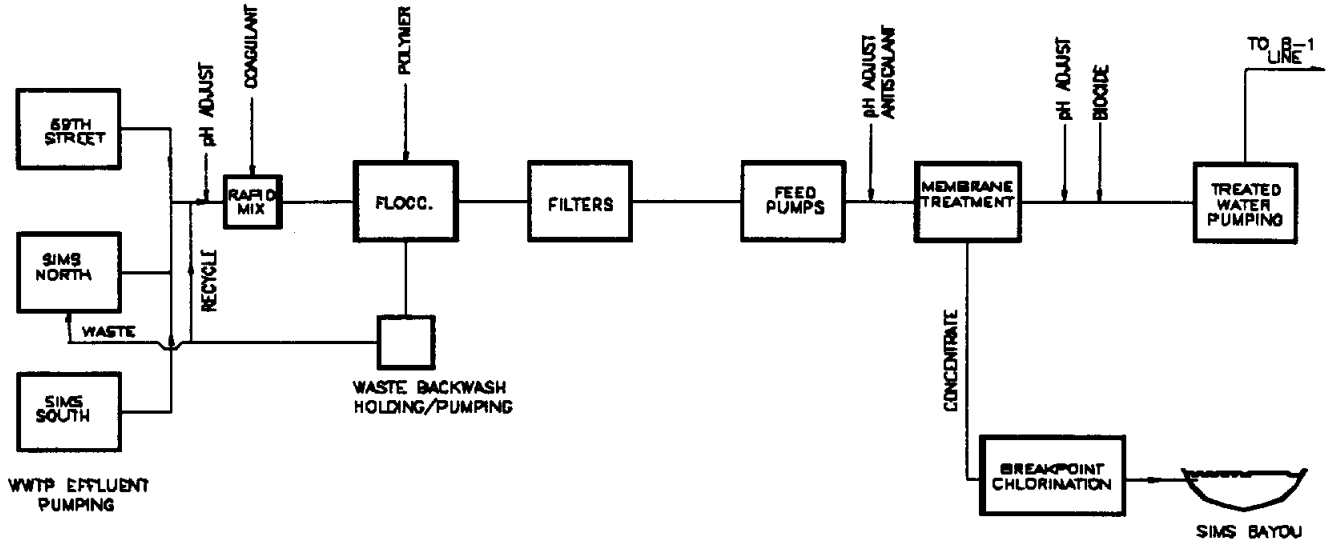


Figure 3.3: Wastewater Reclamation Plant Schematic

- The environmental impacts associated with this strategy do not appear to be significant. The additional WRP salt concentrate disposal into the Houston Ship Channel is similar to existing water quality. Localized environmental impacts from the discharge of nitrate-nitrogen may be mitigated through the removal of ammonia-nitrogen by use of breakpoint chlorination treatment facilities.
- This strategy would have a total capital cost of $103.4 million for an average per unit cost of approximately $825 per acre-foot.

3.5 Systems Operation of Surface Water Supply Sources in the Houston Area

Where a surface water system has more than one source of supply, it is often possible to coordinate operation of the overall system in a way that will produce more yield than could be obtained if the various sources were each operated independently. This study examined the potential gain from coordinated system operation of Lake Houston, Lake Conroe, Lake Livingston and the Wallisville salt-water barrier. Lake Houston and Lake Conroe have been functioning to some degree as a system for over 20 years. It is also generally understood that Lake Livingston and the Wallisville barrier will also function as a system when construction of the barrier is complete. This study reviews the applicable system operation methods, and explains how much additional yield can potentially be gained through these methods.

A technical memorandum, *Systems Operation of Surface Water Supply Sources in the Houston Area*[14] cites the following key items.

- The total current firm yields of the three existing major reservoirs is 1,169,583 af/y based upon the complete use of each reservoir's conservation storage during the critical drought and excluding return flows of treated wastewater.
- The Wallisville salt-water barrier, when complete and in operation, will have no

conservation storage and thus no firm yield. Its benefit is preventing salt water from moving upstream during low flow periods. This "frees" fresh water supplies used to keep salt-water away from diversion intakes on the lower river.

- A gain in firm yield of 101,517 af/y could result from the coordinated operation of Lakes Houston and Conroe due to increased efficiency of operation and minimizing spills at Lake Houston. Operation to maximize system yield would result in severe drawdown of Lake Houston.
- If releases from Lake Livingston are coordinated closely with the natural runoff in the Trinity River downstream from Livingston Dam, the available supply would be increased by 72,147 ac/y.
- The combined additional supply resulting from the coordinated system operation concepts is 173,664 af/y.
- Modeling that assumed less severe drawdown conditions on Lake Houston (leaving moderate volumes in storage) indicates a gain of 135,060 af/y from system operations of Lakes Conroe, Houston and Livingston.
- Modification of existing water rights would be necessary to effectively use these gains.
- The system operation of Lakes Conroe and Houston should have minimal environmental impact on Lake Conroe. Any impacts associated with the altered operation should be positive. The increased instream flows in the San Jacinto River between the lakes should have a positive impact on most aquatic species. A detailed analysis is needed to determine these impacts before plan implementation.
- The reduction in the freshwater flows to the Trinity-San Jacinto estuary resulting from decreased Lake Houston releases should have minimal impacts since it accounts for one percent, or less, of total monthly inflows.
- Impacts to Lake Houston associated with the strategy would be significant under either proposed scenarios, particularly for fisheries and recreational opportunities. A comprehensive analysis of impacts to Lake Houston should be conducted after an operations plan is developed.
- An examination of the siltation and yield loss outlooks for Lakes Houston and Livingston indicate that between years 2000 and 2030 firm yield losses in the two lakes are predicted to be 6,213 af/y and 22,723 af/y respectively. Dredging costs (1997 dollars) to restore these losses would be approximately $3.2 million per year for Lake Houston. Lake Livingston dredging costs would be $23 million per year.

3.6 Allens Creek Reservoir

The Allens Creek reservoir site, located on the west bank of the Brazos River near Wallis in Austin County, was originally planned as a cooling water source for a proposed nuclear power plant. The plant was never developed and the site has been recognized as a potentially valuable strategy for a regional surface water reservoir.

The TTWP investigations include hydrologic studies, costs estimates and environmental impacts of the proposed project. The proposed reservoir would have a conservation capacity of 142,892 acre-feet. It would have

a small drainage area on Allens Creek and would receive supplemental inflows from a Brazos River pump station. Based upon computer simulation the project would have a use rate of 70,000 af/y and a pumping capacity of 1,600 cfs at the Brazos River. The memoranda *Operation Studies and Opinions of Cost for Allen's Creek Reservoir; Volumes I and II* and *Status of Environmental Issues for Allens Creek Reservoir*[15] document the following key findings.

- The median chloride and total dissolved solid concentrations in the reservoir would be approximately 94 milligrams per liter (mgl) and 425 mgl respectively, in accordance with the environmental criteria adopted for studies of the TTWP.
- The impact of the Allens Creek project on instream flows and water quality in the Brazos River would not be significant.
- Environmental impacts of the Allens Creek project include the loss of about 700 acres of wetlands and bottomland hardwoods in the area known as Alligator Hole. Realignment of the northern end of the embankment would exclude Alligator Hole from the reservoir and would be both feasible and desirable.
- Mitigation would be required for the inundation of wetlands and riparian zones. Including Alligator Hole, wetlands total 1,628 acres, and there are 480 acres of bottomland hardwoods. Acreage of required mitigation wetlands might vary from 3,256 to 8,140 acres.
- Several significant archeological sites will be adversely impacted by the proposed project. These impacts may be mitigated by prior recovery efforts at the site.
- Several endangered and threatened species may be impacted by the proposed reservoir. Surveys for some of these species may be required and impacts, if any, addressed at that time.
- The proposed project will require a Texas Natural Resource Conservation Commission water rights permit, a U.S. Army Corps of Engineers permit issued under Section 404 of the Clean Water Act and other permits. It will also require review by the Federal Emergency Management Agency (FEMA) and the local floodplain administrator for compliance with FEMA regulations. Local governmental review may also be required.
- The project is estimated to generate $24 million to $67 million annually through enhanced recreational use.
- The project would have a capital cost of $169 million for a unit cost of $351 per acre-foot with an average present worth unit cost of $0.28 per thousand gallons.

3.7 Neches Salt Water Barrier

The Neches River saltwater barrier project at Beaumont has been proposed as a means of protecting the fresh water supplies of the Lower Neches Valley Authority (LNVA) and the City of Beaumont. Both LNVA and Beaumont have water supply intakes located below sea level and these are threatened with saltwater flows during times of low flow in the river. Releases of fresh water from the B. A. Steinhagen/Lake Sam Rayburn system supplement natural inflows below the lakes to prevent salt water from reaching these intakes. Releases from the system represent a significant loss of usable freshwater yield from the lake system.

The construction of temporary salt water barrier structures provide some protection from the salt water intrusions but, due to the temporary condition of the barrier, fresh water supplies from the Steinhagen/Rayburn system must be reserved to provide the flows necessary to prevent salt water intrusion if needed. The construction of a permanent salt-water barrier would provide a permanent solution to the problem and free up fresh water yield for municipal, industrial or other use. The *Environmental Analysis for the Neches Salt Water Barrier; Beaumont, Texas*[16] evaluates the existing environmental conditions and potential impact of construction, operation and maintenance associated with the structure.

The proposed plan (Site #6), located at river mile 29.7, protects both LNVA and the primary City of Beaumont intake structures from salt water intrusion. It eliminates several problems associated with the temporary barriers and promotes benefits to the natural and human environment. The study concludes that the permanent barrier would accomplish the following.

- Restore year round fresh water to the Neches River and Pine Island Bayou.
- Improve upstream water quality and thereby enhance the overall aquatic habitat and recreation value of the river.
- Free up usable yield in the Steinhagen/Rayburn system.
- Support the natural conditions of and provide unrestricted boat access to the Big Thicket National Preserve (BTNP).
- Allow private and commercial navigation of the river.

There are however potentially significant environmental impacts associated with the construction and operation of the permanent barrier. These include the loss of 60 acres of high quality cypress-tupelo swamp and bottomland hardwood as well as wetlands, emergent aquatic vegetation and scrub shrubs and potential impacts to several threatened or endangered species or their habitats. The report notes several issues that must be addressed before a complete picture of the full impacts can be established including: an in-depth Habitat Evaluation Procedure; cultural resource survey; and permitting and regulatory issues regarding compliance with Federal Emergency Management Agency floodplain regulations and the Texas Coastal Coordination Council's Texas Coastal Management Plan.

Construction of the permanent saltwater barrier at the proposed location would "save" 156,800 af/y of firm yield from the Rayburn/Steinhagen system that could be allocated to municipal, industrial or other use. The analysis indicates that this strategy would have a capital cost of $60.4 million equaling a unit cost of approximately $35 per acre-foot.

3.8 Contractual Transfers

A contractual water transfer is the temporary or permanent transfer of water supplies from one party to another that may or may not involve an exchange of water rights. The primary advantage of contractual transfers is the opportunity to reduce or defer the construction of major new water conveyance facilities. Contractual transfers range from the simple execution of agreements between two parties for the re-allocation of existing supplies to more complex transfers including construction of physical facilities that allow replacement of supplies. Contractual transfers make the most efficient use of existing water supplies by allocating available supplies to entities needing the water.

Four specific contractual transfer alternatives were recommended for further study in Phase II of the TTWP Southeast Area. These four alternatives include:

- Replacing Brazos River water owned by the Gulf Coast Water Authority with other available supplies.
- Replacing Lake Conroe water owned by City of Houston with other available supplies.
- Replacing City of Houston and Trinity River Authority water with other available supplies in order to meet West-Central study area needs.
- Transferring irrigation water supplies to municipal or industrial purposes.

The results of these investigations are reported in the technical memorandum *Contractual Transfers.*[17]

3.8.1 *GCWA/Brazos*

- The GCWA/Brazos contractual transfer could potentially replace approximately 122 mgd (136,600 af/y) of Brazos River water at the Texas City Reservoir with Trinity River water supplies, making available that same quantity of new supply into the Brazos basin.
- The GCWA/Brazos transfer requires construction of water system improvements with a construction cost of approximately $100 million. The cost of developing this project is approximately $455 per acre-foot.

3.8.2 *City of Houston/San Jacinto*

- The City of Houston/San Jacinto contractual transfer provides for the reallocation of existing water supplies between the City of Houston and the SJRA. The purpose of this transfer is to satisfy the long-term water needs of Montgomery County through year 2050 by allocating all of the City's Lake Conroe water supplies (66,667 af/y) to the SJRA. In exchange, the SJRA would contract an appropriate quantity of their current supplies within the lower San Jacinto River basin to the City of Houston.
- There are no physical facilities needed to accomplish the City of Houston/San Jacinto basin transfer; therefore no capital cost is required. Likewise, no environmental impacts are associated with this strategy because all of the existing water supplies, water facilities, and permits are in place to accomplish the necessary contractual transfers. However, there are a number of institutional issues associated with valuation of water supplies and future use of water system facilities that would have to be determined by each of the contracting parties.

3.8.3 *City of Houston/Trinity*

- The City of Houston and Trinity River Authority/Trinity basin contractual transfer could provide the mechanism to facilitate conveyance of large quantities of water supply from the TTWP Southeast Area to the West-Central Area. This transfer utilizes the strategic location and capacity of Lake Livingston to provide for the transfer of 300,000 or 600,000 acre-feet/year from the Trinity basin to the Brazos basin. This contractual transfer consists of conveying east Texas water supplies via interbasin transfer into the lower Trinity River basin for use by the City of Houston and the Trinity River Authority. These supplies would supplant existing City of

Houston and TRA water supplies in Lake Livingston and therefore allow conveyance of similar quantities of supply to the Brazos basin for use by TTWP West-Central water supply entities.

- The incremental capital cost of supplying 300,000 and 600,000 af/y to the West-Central Area is approximately $307.5 million and $575.4 million, resulting in a water cost of approximately $1025 and $960 per acre-foot, respectively.

3.8.4 *Irrigation*

- Irrigation contractual transfers are possible due to the expectation that a significant decrease in water demand will occur for irrigation interests with senior water rights from the Sabine, Neches, Trinity, and Brazos Rivers. Potentially available irrigation water supplies are projected to increase from approximately 475,000 af/y in year 1990 to over 641,000 af/y in year 2050. These available supplies are established within existing water rights permits and are reliable senior rights that could be used for municipal and industrial water use purposes.
- Based on the location of these irrigation supplies, it is expected that the Brazos basin supplies (44,400 af/y) will remain in that basin and be re-permitted for municipal and industrial uses. No new water system improvements would be necessary to make these supplies available to the region.
- A total of approximately 178,000 af/y of irrigation supplies are projected to become available within the lower Trinity basin. These supplies would have to be transferred to municipal and industrial water suppliers, but no significant new water system improvements would be necessary to make use of these supplies.
- Approximately 418,300 af/y of irrigation supplies are projected to be available within the lower Neches and Sabine River basins. These supplies represent over 50% of the total available irrigation supplies within the entire TTWP Southeast Area. Use of these supplies would require construction of an interbasin conveyance system with a capital cost of approximately $215.4 million and a water cost of approximately of $955 per acre-foot. Significant institutional and equity issues would also require resolution in order to implement this contractual transfer opportunity.

3.9 Interbasin Transfers

Transfer of surplus water supply from the Sabine and Neches River basins to the Houston Metro area or areas west of the Southeast Study Area was one of the initial program goals. The Phase I Report identified specific transfer routes for further study to determine which ones were most environmentally favorable. The *Environmental Analysis of Potential Transfer Routes*[18] documents the results of this study. The conceptual design and cost estimates for the transfer route segments that were recommended for the Trans-Texas Interbasin Transfer Strategy are described in *Engineering Analysis of the Interbasin Transfer Strategy.*[19] Together these reports define the TTWP interbasin transfer strategy.

Three transfer scenarios are evaluated:

Scenario 1: Out-of-region transfers needed up to 600,000 af/y to the San Antonio area beginning in year 2020;

Scenario 2: Additional supply availability west of the Southeast Area delaying trans-

fers until year 2030 and reducing the needed volume of out-of-region transfers to 300,000 af/y;

Scenario 3: Extensive development of local supplies west of the Southeast Area with no out-of-region transfers required.

All of these scenarios assume interbasin transfer of water within the Southeast Area to meet the area's needs. Water from the Trinity Basin is transferred westward to the Houston area to meet local shortfalls by year 2030. By 2050, shortfalls are expected to exceed the supply available from other sources within the Southeast Area and transfers from the Sabine and Neches Basins will be required to meet in-region demands.

The existing environment along each of 16 transfer segments is described in terms of:

- length,
- compatible land use,
- threatened and endangered species,
- river and stream crossings,
- wetlands,
- water quality,
- prime farmland soils,
- geology,
- public lands, and
- traffic.

Sensitive natural communities, vegetation areas, fisheries, and cultural resources are discussed for the general vicinity surrounding the segments. Static lift, or the total increase in elevation from the beginning to the end of a segment, is also included in the general description of each segment. Based on these criteria and the level of potential environmental impacts predicted three preferred segments were recommended for further consideration:

- Sabine River to Neches River, Segment SN-4b;
- Neches River to Trinity River, Segment NT-3b; and
- Trinity River to Brazos River, Segment TB-1.
- Additional segments evaluated to provide for transport to the Houston Metro area including Trinity River to San Jacinto River, Segments TS-3b and for San Jacinto river to Brazos River, Segment SB-1b.

For further information on the environmental evaluation please refer to the report. A map of alternative route segments is included as Figure 3.4.

The conceptual planning assumed that existing facilities would be used whenever possible including the Sabine River Authority canal and pump station, Lower Neches Valley Authority Main Canal and pump stations, and the Coastal Water Authority canal and pump station. Consideration for canal losses, terminal storage, seasonal variation and wetlands mitigation requirements were included in the analysis. Water wheeling, the contractual transfer or "trading" of water, discussed later in this report, is also assumed for this project.

The engineering analysis concludes that, for the routes recommended based on the environmental screening, the following costs can be predicted.

Scenario 1 meets the needs of the Southeast Area and also exports 600,000 af/y to the Brazos River for a maximum export of 1,018,000 acre-feet per year by year The route segments used are SN-4b, NT-3b, TS-

3b, TS-4b, and TB-1. This scenario will have a total capital cost of $791 million, an average cost of $607 per acre-foot or a present worth average cost of $0.23 per 1,000 gallons.

Scenario 2 meets the Southeast Area's needs as well as export 300,000 af/y for a total maximum export of 718,000 af/y by year 2040. This scenario uses the same transfer route as Scenario 1 and has a capital cost of $523 million, an average acre-foot cost of $830 or a present worth average cost of $0.27 per 1,000 gallon.

Scenario 3 meets only the Southeast Area's needs with no out-of–region exports. It uses route segments SN-4b, NT-3b, TS-3b, TS-4b to transfer 418,000 af/y from year 2040. The capital cost is $215 million, average costs for this supply will be $955 per acre-foot or a present worth average cost of $0.24 per 1,000 gallon.

4. Summary of Results

The purpose of the TTWP was to evaluate a full range of water management strategies identifying the most cost-effective and environmentally sensitive strategies for meeting current and future water needs for one-third of the state's citizens. The Southeast Area, with some of the fastest growing communities in the nation, focused its efforts on

a. defining the projected water needs for each county and use type,

b. determining the level of existing water supply available by location and permitted use, and

c. examining specific water management strategies which can provide additional water supply to meet the region's future needs and the future needs of areas outside the Southeast Area.

The previous sections of this report have summarized each of these activities.

It is useful to review the results of each technical study in light of the demands identified for the Southeast Area and in the South -, West -, and North - Central portions of the state.

4.1. Southeast Area Population Projections

The population projections for the Southeast Area indicate that by 2050 there will be a total of 9.8 million people in the region. The Sabine River Basin will have the smallest population and the San Jacinto River Basin will have the greatest. Projections indicate a 165 percent increase in population over the 50 years for the San Jacinto - Brazos Coastal Basin but increases of 28 percent over the same time frame for the Trinity-Neches Coastal Basin. Table 4.1 details the population projections for the region.

4.2. Southeast Area Projected Water Demand

The *Planning Information Update* indicates that water demand within the Southeast Area will grow to almost 4 million acre-feet per year by 2050, an increase of 146 percent from the 1990 demand estimates. The San Jacinto, Brazos and Sabine River basins, service areas for the

Table 4.1: Population Projections for the Southeast Study Area, 1990 - 2050

	Population (Thousands)						
River Basin	*1990*	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Sabine	107	116	124	130	137	142	148
Neches	315	354	384	414	447	478	509
Neches-Trinity	194	210	220	231	238	244	249
Trinity	153	180	201	225	250	270	289
Trinity-San Jacinto	96	118	136	159	173	191	206
San Jacinto	2,771	3,208	3,737	4,389	4,839	5,365	5,783
San Jacinto-Brazos	705	857	1,034	1,247	1,459	1,675	1,874
Brazos	304	347	408	473	544	617	697
Total, Southeast Area	4,646	5,390	6,244	7,267	8,086	8,983	9,755

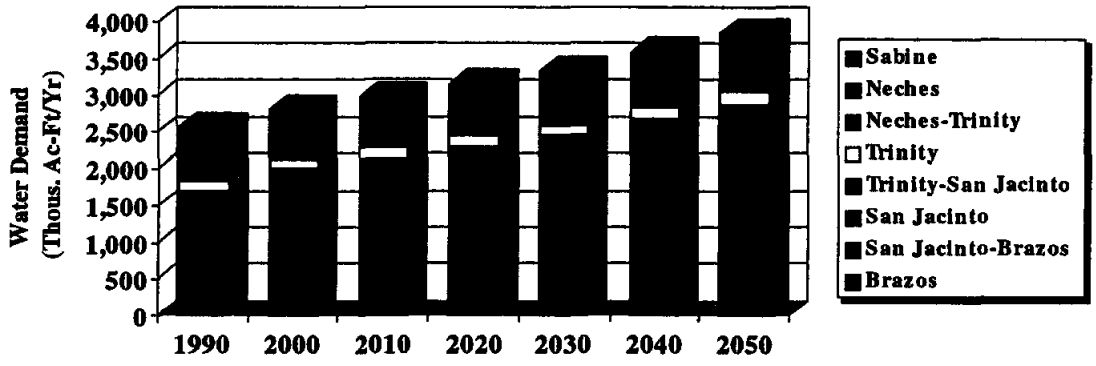


Figure 4.1: Cumulative Water Requirements for the Southeast Area

Houston Metro area, account for the largest predicted increases. The basins on the eastern side of the region experience the lowest demand increases. Figure 4.1 illustrates the demand projections for each basin in the Southeast Area over the 50-year program.

4.3. Central Texas Water Demands

In addition to water demands within the Southeast Study area, the TTWP examines the potential for meeting Southeast Area demands and, in addition, transferring "surplus" supply to other TTWP study areas in central Texas. Three scenarios are investigated; transfers of 600,000 af/y, transfers of 300,000 af/y, and no transfers of Southeast Area supply west of the Brazos River basin.

Groundwater, surface water captured in reservoirs, and run-of-river sources comprise the available water supply within a river basin. Section 3.0 of the *Phase I Report* defines, in detail, the sources and amounts of groundwater and surface water supplies in the Southeast Area. In summary, estimates of groundwater pumpage in the region range over time from a low of 0.7 million af/y to a maximum of 0.9 million af/y. Total existing surface water available in the region amounts to 4.2 million af/y, which includes 495,800 af/y of run-of-river yield.

These supplies are not distributed evenly over the Southeast Area but are heavily concentrated in the eastern part of the Southeast Area, specifically in the Sabine, Neches and Trinity River Basins. Figure 4.2 illustrates this and its impact on long-term supply availability in the Southeast Area. Over time, supply shortages appear in the basins on the west side of the Southeast Area while significant supplies remain in the eastern basins. Interbasin transfers currently move water from water rich basins to the high demand areas in the San Jacinto River and coastal basins or shortages would already be occurring in the region. These transfers are permitted under existing water rights and will continue in the future. Further transfers will be needed to meet future demands both in the Southeast Area and in the rest of the state.

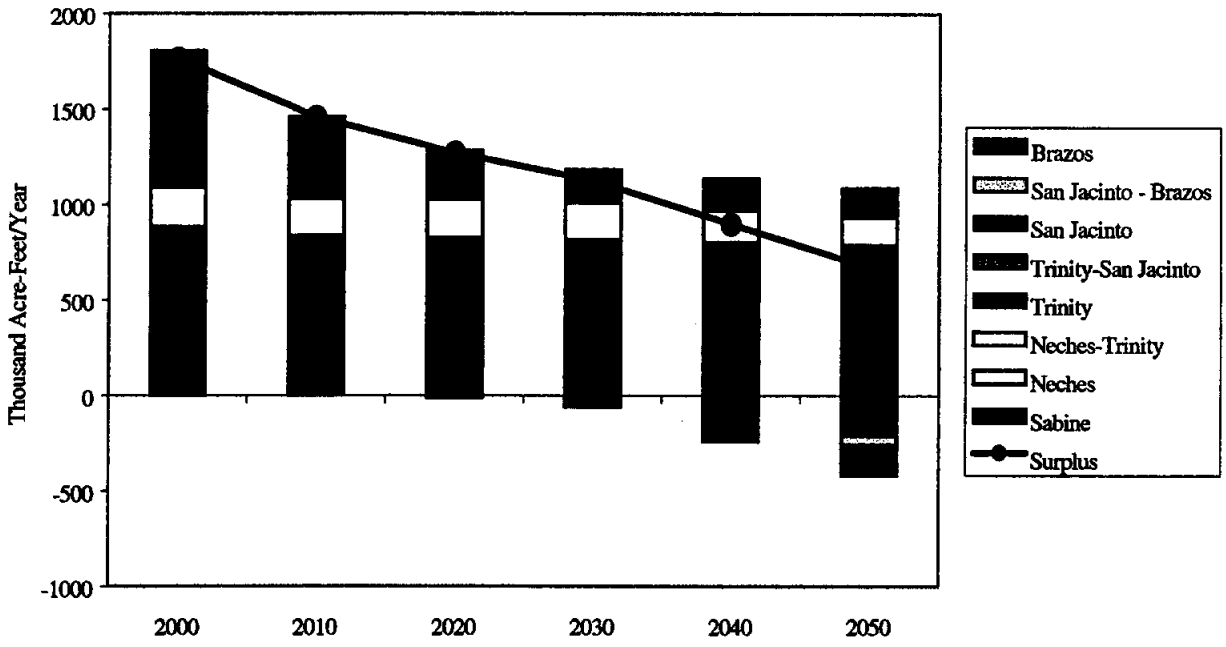


Figure 4.2: Southeast Area Water Supply Availability by Basin

4.4. Water Management Alternatives

The TTWP investigated 8 basic water management strategies; each reviewed in previous sections of this report. The purpose of these investigations was to explore new methods of meeting future demand requirements within the Southeast Area and in central Texas. Table 4.2 compares each of the technical strategies for additional supply generated (or saved), the cost to construct, cost per acre-foot of supply and the potential impacts on environmental, social and economic systems. The table also notes the proposed destination and the time frame for new supply resources.

4.5 Conclusions

There are several conclusions to be drawn from all of the assembled planning and technical data.

- The Southeast Area has a surplus of available supply. The supply is adequate to meet all regional needs through and beyond 2050, the planning horizon of the TTWP. Available water resources are adequate to meet all TTWP demands, both the Southeast Area needs and those of Central Texas.
- There is a disparity between resource centers (basins with "surplus" supply) and demand centers (basins with supply shortages). See Figure 4.2.
- Due to the need for additional supplies at differing times over the TTWP hori-

zon, it is unlikely that any single water management strategy could efficiently satisfy all TTWP supply requirements but implementation of a range of strategies is more likely to meet the TTWP goals.

- Implementation of water management strategies can extend the period of adequate supply and delay the need for developing new resources in areas of shortage. These strategies include water conservation in the Houston Metro area, contractual transfers between basins, and systems operations of Lakes Houston and Livingston. Combined, these strategies could delay the need for major new resource development by 15 to 20 years.
- Other strategies can increase the water supply from existing facilities such as the Neches Salt Water Barrier project. This strategy creates "new supply" from existing supplies not currently available for use.
- The development of Allens Creek Reservoir can, at a reasonable cost, provide a new supply source for the western side of the Southeast Area or act as a transfer-regulating storage reservoir for supplies being shipped from the Southeast Area to Central Texas.
- Many of the alternative strategies require interbasin transfers to connect supply and demand centers or to "wheel" water resources.
- Large-scale interbasin transfer of Sabine River supply is the only strategy that could solely meet the long-range Southeast Area demands and the demands of central Texas.
- Desalination, while a viable alternative, can not compete economically in the Southeast Area with other strategies at this time. In addition to its economic cost, desalination may have significant environmental impacts that will require further study before this alternative could be recommended.

It is also clear from these studies that providing for the long-range water needs of any single community will be increasingly difficult. Long-range planning requires a broader perspective than that of one community's need or source of supply. The issues facing tomorrow's facility planners extend beyond the corporate limits of cities or county boundaries. Issues such as public access to and consent on decisions regarding major construction projects, environmental and economic issues, questions of equity between exporting and importing basins will all require decision makers to take a broader view and to involve the public in the planning process. The TTWP provided valuable experience in learning how to identify interested parties, engage them in a discussion of these issues and involve them in the decision-making process.

Table 4.2: Comparison of Alternative TTWP Water Management Strategies

Alternative Strategy	Supply (Acre-feet per Year)	Capital Cost (Million Dollars)	Per Unit Cost (Dollars per Acre-foot)	Present Worth Average Cost ($/1,000 gals)	Environmental Impact	Social / Economic Impacts	Supply Destination	Comments
Water Conservation*	63,626	N/A	$ 120	0.11	Minimal	Minimal	Houston Metro Area	Short Term Supply
Desalination*	44,600	$ 151	$ 1270	1.31	Significant	N/A	Houston Metro Area	Mid Term Supply
Neches Salt Water Barrier	156,800	$ 60.4	$ 35	0.04	Moderate	Minimal	Beaumont Area	Short / Mid Term Supply
Wastewater Reclamation	90,700	$ 103.4	$ 825	0.83	Moderate	N/A	Houston Metro Area	Mid Term Supply
System Operation								
Scenario 1	173,664	0	0	0	Moderate	Moderate	Houston Metro Area	Short Term Supply
Scenario 2	135,060	0	0	0	Moderate	Moderate	Houston Metro Area	Short Term Supply
Allens Creek Reservoir	70,000	$ 169	$ 351	0.28	Significant	Positive	Houston Metro Area	Long Term Supply
Interbasin Transfer								
Scenario 1	1,018,000	$ 790.8	$ 607	0.23	Significant	Moderate	SE / Out of Region	Long Term Supply
Scenario 2	718,000	$ 522.9	$ 830	0.27	Significant	Moderate	SE / Out of Region	Long Term Supply
Scenario 3	418,000	$ 215.4	$ 955	0.24	Significant	Moderate	Houston Metro Area	Long Term Supply
Contractual Transfer								
GCWA / Brazos	136,600	$ 100.6	$455	0.46	Moderate	N/A	Houston Metro Area	Mid Term Supply
COH / San Jacinto	0	0	0		None	None	Houston Metro Area	Short Term Supply
COH & TRA / Trinity							Out of Region	Long Term Supply
Scenario 1	600,000	$575.4	$1025	0.23	Significant	Moderate	Out of Region	Mid Term Supply
Scenario 2	300,000	$307.5	$960	0.27	Significant	Moderate		
Irrigation								
-Sabine & Neches	418,300	$215.4	$955	0.24	Significant	Moderate	Houston Metro Area	Long Term Supply
-Trinity	178,000	0	0	0	None	Moderate	Houston Metro Area	Mid Term Supply
-Brazos	44,000	0	0	0	None	Moderate	Houston Metro Area	Mid Term Supply

* Treated Water

\+ Raw Water

5. The TTWP Legacy: Senate Bill 1 Regional Water Planning

In 1997 the Texas State Legislature passed the Omnibus Water Bill designated as Senate Bill 1. This bill directs sweeping changes in the way water resource planning will be conducted in this state. Among other things, it requires water master planning at the regional level for the entire state. From the year 2000 the State Water Plan will be a composite of the plans from some 16 regions. These plans must determine regional needs and available supplies evaluate alternative methods of meeting their water needs, involve a broadly defined public in the decision-making process, and acknowledge competing needs and equity issues in its plan. The TTWP was the forerunner of this bill.

The Trans-Texas Water Program grew out of a Southeast Area initiative to look at long-range water supply planning from a regional, multi - basin approach. In 1992, Mayor Bob Lanier convened a meeting of leaders from major demand centers in the state, Houston, San Antonio, Corpus Christi and Austin, and the primary water providers, the local river authorities, to discuss how rational, cost-efficient and environmentally sound solutions to long-range water supply could be accomplished. The State found merit in this regional approach and supported the effort creating the TTWP. Local sponsors of the Southeast Study Area have benefited from the program is several ways:

- Technical studies associated with the TTWP put the local sponsors far ahead in the newly mandated regional planning processes.
- Planning data have been assembled for each county and use type. Detailed information of water resources have been collected and evaluated.
- Specific management strategies have been investigated as to their engineering, economic and environmental appropriateness for local use.
- TTWP developed new methods of involving the public in making decisions and choosing among alternative solutions.
- Local interests and issues were identified and discussions on key issues of concern are on-going as with the Galveston Bay Freshwater Inflows Group.
- Needed environmental research has been conducted under TTWP including the Sabine Lake Conference and the Sabine Lake Salinity Study. This research will be crucial to decisions regarding water exports from the basin and protecting the river, adjacent wetlands, and lakes from environmental damage.
- Important issues of equity for "third party" interests in the Sabine and Neches Basins were identified and mechanisms for representing these interests explored. These issues and the need to accommodate them are recognized in SB1.
- Valuable partnerships have been forged both among different interests in the state and with Louisiana, which shares the Sabine River, Toledo Bend Reser-

voir and the Sabine Lake system with Texas.

The road ahead for water resource planning is changed because of the TTWP. Decision-makers will look for regional solutions and opportunities. They will engage local citizens and interest groups in decision making. They will consider a wide range of alternative strategies when seeking solutions and they will evaluate these strategies over a wider range of criteria including engineering and economic criteria but also environmental and social ones. They will coordinate their planning efforts with others within their region and those of neighboring regions. They will be partners with the state planning authorities in shaping the elements of the State Water Plan for the next century.

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Appendix

Appendix A: TTWP Southeast Study Area Scope of Work

Appendix B: Technical Advisory Committee Members

Appendix C: Southeast Study Area Meetings

Appendix D: Interview Protocols

Appendix E: Southeast Area Water Availability with Advanced Conservation Strategy

Appendix F: Comment Letters and Responses

Appendix A

TRANS-TEXAS WATER PROGRAM - SOUTHEAST AREA
SCOPE OF SERVICES FOR PHASE II

1.0 PLANNING STUDIES

1.1 Upper Basin Needs

The Upper Sabine Basin and the Upper Neches Basin are outside of the Southeast Area of the Trans-Texas Water Program (TTWP), but both areas have water needs that might be supplied from the Southeast Area. (The areas of the Brazos Basin and the Trinity Basin upstream from the Southeast Area are not likely to require supplies from within the study area.)

1.1.1 Using Texas Water Development Board (TWDB) "Consensus Water Planning" data, develop projected water needs through year 2050 for the Upper Sabine Basin and the Upper Neches Basin.

1.1.2 Meet with the Sabine River Authority (SRA), Lower Neches Valley Authority (LNVA), the Angelina & Neches River Authority, and the Upper Neches River Municipal Water Authority to review the projected water needs, available in-basin sources of water supply, potential future sources, and potential sources for import. Consider issues such as availability, reliability, cost, water quality, regional permits, local preferences, and environmental impacts.

1.1.3 Prepare a draft memorandum report on the water needs and potential supplies for the Upper Sabine Basin and the Upper Neches Basin. Outline the impact of various scenarios of future supply development on the availability of water for the Southeast Area.

1.1.4 Review the memorandum report with the SRA, LNVA, the Angelina & Neches River Authority, and the Upper Neches River Municipal Water Authority. Review the memorandum report with the Southeast PMC and TAC.

1.1.5 Respond to comments and prepare a final memorandum report on the projected needs of the Upper Sabine Basin and the Upper Neches Basin, potential sources of supply, and the effect on water availability for the Southeast Area of the TTWP.

1.2 Planning Information Update

1.2.1 Collect "Consensus Water Planning" information from the TWDB regarding the location and nature (water quantity, etc.) of projected population, and water demand within the study area. Assess demand for study years 2000, 2010, 2020, 2030, 2040, and 2050 on a gross basis (municipal, industrial, agricultural, and irrigation) within each river basin study area using the TWDB "Most Likely" projection series.

1.2.2 Using the water supply (groundwater and surface water), and import/export estimates generated in Phase I of the TTWP, create an allocation of supply versus water demand for each study year. Prepare a table illustrating future water surpluses and shortages in each basin.

1.2.3 Prepare a report memorandum which compares and contrasts the results determined above with similar results shown in the Phase I Report.

1.2.4 Review the memorandum report with the Southeast PMC and TAC.

1.2.5 Respond to comments and prepare a final memorandum report for submittal to the PMC.

1.3 Analysis of the Impact of Toledo Bend Water Right Revisions

1.3.1 Obtain monthly historical inflow data for Sabine Lake from TWDB. Use these data for 1941 through early 1965 (prior to development of Toledo Bend Reservoir and Sam Rayburn Reservoir) to develop a conservative estimate of the inflow needs of Sabine Lake for each month as defined in the Environmental Criteria (attached) for the Trans-Texas Water Program. Determine the inflows beyond the conservative estimate of needs for each month, if any. Determine the portion of the conservative estimate of needs that was provided by inflow from the Sabine River upstream from the Ruliff gage.

1.3.2 Using data from the latest Toledo Bend Reservoir yield study (July 1991), conduct a monthly operation study for 1940 through 1989 of the currently permitted operation of Toledo Bend Reservoir. The study would include the following assumptions:

- Louisiana is assumed to use its entire share (1,043,300 acre-feet per year) of the maximum computed yield.
- Louisiana is assumed to use 90% of its share for hydropower generation and 10% for water supply.
- There is assumed to be no return flow to Sabine Lake from Louisiana's water supply use. (It is assumed to be exported from the lower Sabine Basin.)
- Texas uses 750,000 acre-feet per year in the Sabine Basin, as currently permitted.
- Texas' 750,000 acre-feet per year is used for municipal, industrial, and irrigation water supply in the Sabine Basin as established in the existing permits.
- Return flows from the municipal, industrial, and irrigation water rights are based on historical patterns for the lower Sabine Basin.

1.3.3 Use the information from the TWDB and from the Toledo Bend Reservoir operation study in 1.3.2 above to estimate monthly inflows to Sabine Lake from the Sabine River for 1941 through 1989 with Toledo Bend Reservoir operating as currently permitted. (Use the flows from the Sabine River upstream from the Ruliff gage plus return flows from the use of Toledo Bend water.)

1.3.4 Conduct a second monthly reservoir operation study for Toledo Bend Reservoir assuming that the following changes are made to existing water rights:

- Diversion of the total maximum yield of 2,086,600 acre-feet per year.

- Diversion of 600 mgd of Texas' supply out of the Sabine and Neches basins with no return flows to Sabine Lake.

1.3.5 Use information from the TWDB and from the Toledo Bend Reservoir operation study in Task 1.3.4 above to estimate monthly inflows to Sabine Lake from the Sabine River for 1941 through 1989 with Toledo Bend Reservoir operating as defined in Task 1.3.3 above. (Use the flows from the Sabine River upstream from the Ruliff gage plus return flows from the use of Toledo Bend water.)

1.3.6 Compare the operation of Toledo Bend Reservoir under the current water rights (1.3.2) to the operation with the potential water rights changes (1.3.4). Determine the impact of the water rights changes in the following areas:

- Changes to Toledo Bend Reservoir lake levels.
- Changes to spills from Toledo Bend Reservoir.
- Changes to monthly inflows to Sabine Lake from the Sabine River.

1.3.7 For the period from 1941 through early 1965 for which the estuary needs as defined in the Trans Texas Environmental Criteria was determined in Task 1.3.1, determine the monthly contribution from the Sabine River upstream from the Ruliff gage plus return flows from the use of Toledo Bend water for the following conditions:

- Historical flows.

- Toledo Bend Reservoir operating as currently permitted.

- Toledo Bend Reservoir operating per the conditions within Task 1.3.4.

Compare these contributions to the portion of the conservative estimate of needs that was provided by the Sabine River upstream from the Ruliff gage under historical conditions. Analyze and discuss months in which the portion of the conservative estimate of needs that was provided by the Sabine River upstream from Ruliff would not be provided. Relevant issues include:

- The frequency of shortages.

- The months in which shortages occur.

- The degree to which the changes to water rights from current permits affect the shortages.

- The amount of historical inflow from other sources in excess of the conservative estimate of needs for months in which there are shortages to inflows from the Sabine River.

1.3.8 Develop graphical and statistical analyses of the impacts of changes on lake levels, spills from Toledo Bend Reservoir, flows in the Sabine River, and inflows to Sabine

Lake. Prepare a preliminary qualitative analysis of the effects of these changes on the recreational use of Toledo Bend Reservoir; fisheries and other in-stream uses in the Sabine River; and salinities, fisheries and other resources in Sabine Lake.

1.3.9 Prepare a memorandum report presenting the analyses and results. Meet with the SRA, TWDB, TNRCC, and TPWD to discuss the results. Revise the memorandum report to reflect input from the agencies at that meeting and to include their input on potential restrictions of changes in Toledo Bend Reservoir water rights to reflect environmental values. Determine the impact of potential restrictions to protect environmental values on the yield of Toledo Bend Reservoir.

1.3.10 Review the memorandum report with the Southeast PMC and TAC.

1.3.11 Respond to comments and prepare a final memorandum report for submittal to the PMC.

1.4 Additional Studies of Desalination

1.4.1 Obtain and review existing data on the availability of brackish groundwater in the Southeast Area, especially near the major demand center in the Houston SMSA.

1.4.2 Develop preliminary estimates of the cost of desalination on the basis of available data.

1.4.3 Prepare a memorandum discussing the use of desalination as a source of water supply for the Southeast Area. Distribute the memorandum to the Southeast Area TAC.

1.5 Sabine Lake Characterization

The environmental condition of Sabine Lake is not currently known. Additionally, there is a lack of understanding regarding the hydrodynamic and water quality processes which occur within the lake. This task compiles and makes public the available data and studies on Sabine Lake.

1.5.1 Compile existing hydraulic, biologic, limnotic and aquatic information on Sabine Lake from governmental agencies, the academic community and others. Organize and format the information to serve as a resource for interested parties.

1.5.2 Coordinate a Sabine Lake, State of the Lake Conference. The conference will be structured to:

- Disseminate information on Sabine Lake and studies from other similar lakes to the public through seminar presentations and published conference proceedings.
- Identify subject areas where additional investigation is required.
- Define the current baseline condition of the lake based on known information.
- Serve as a forum to obtain public input related to Sabine Lake.

1.6 Galveston Bay Freshwater Inflows Assessment

This task will develop a process that will lead to resolution of concerns about freshwater inflows to Galveston Bay. Sufficient analysis will be performed to define necessary management issues. Future additional studies (outside of TTWP) will be required to assess the technical feasibility of potential management strategies.

1.6.1 Establish the Galveston Bay Freshwater Inflows Group (GBFIG). Establish a GBFIG participant workgroup of interest parties, water suppliers, and state water agencies. This workgroup will develop a mission statement, workplan, and obtain formal recognition.

1.6.2 Obtain necessary background information. Through a series of meetings, present known data on hydrologic, aquatic, and human conditions surrounding the bay system. Provide an understanding of water rights, existing modeling efforts, and reservoir system operating procedures.

1.6.3 Conduct analyses required to determine under what hydrologic conditions would freshwater inflows be inadequate. Perform analyses of the following:

- naturalized monthly flows
- monthly flows with existing diversions, return flows, and interbasin transfers
- monthly flows of future conditions exercising full use of current water rights

Based on the above models, determine required inflow targets and determine the statistical frequency (if any) of not meeting each target.

1.6.4 Facilitate discussion to identify potential management strategies that may be used to address any identified problem conditions. Develop an outline (scope and budget) of necessary future hydrologic analyses necessary to study the impact of each identified management strategy.

1.6.5 Identify future procedural actions (organizational, management, funding, etc.) necessary to continue analysis of the issues surrounding Galveston Bay freshwater inflows.

1.7 Phase II Interim Update

This task consists of reassessing the direction of the project based on the results of Task 1.2, Planning Information Update. Use of revised population and water demand planning information may necessitate revision in the future remaining project task elements.

1.7.1 Using the results from Task 1.2, reassess the Trans-Texas Water Program Phase I Report conclusions and recommendations regarding proposed Phase II analysis of water resource management alternatives, necessary studies, and the planned scope of work.

1.7.2 Recommend modifications to the scope of work, project direction, and Phase II goals, as appropriate, based on the results of Task 1.7.1.

1.7.3 Prepare a draft technical memorandum that describes the re-assessment and any new recommendations in project direction, proposed work tasks, and goals.

1.7.4 Review the draft technical memorandum with the Southeast PMC and TAC. Respond to comments and prepare a final memorandum report for submittal to the PMC.

1.8 Water Transfer Socio-Economic Analysis

This task defines methods of addressing conflicts concerning socioeconomic impacts of water transfers. Perceptions regarding equity of water allocation need to be addressed as an obstacle to undertaking any future water transfers.

1.8.1 Collect and review the literature documenting techniques of conflict resolution and natural resource planning (Integrated Resource Planning) to find approaches that may be applicable within the Trans Texas Water Program. Conduct telephone interviews with project participants, particularly the professional staffs, who were involved in several such cases.

1.8.2 Identify and categorize methods and incentives used to address perceived equity issues. In addition to mechanisms or incentives identified from the literature review and case studies, develop other techniques that may be suitable and feasible.

1.8.3 Compile and organize information from the Phase I interviews about forms of compensation that would make a water transfer more equitable. Conduct additional interviews with specific individuals to supplement the Phase I data. In a series of meetings coordinated with the Southeast Regional Planning Commission, discuss the methodologies and specific Southeast Area water equity concerns to determine potentially viable compensatory frameworks. This information will be organized in terms of the methodologies defined in Task 1.8.2.

1.8.4 Working from the available mechanisms and incentives previously identified, recommend a framework for resolving water transfer conflicts in the Southeast Area of the TTWP.

1.8.5 Prepare a draft technical memorandum report that describes equity issues in the Southeast Area, documents the literature review and interviews, assesses the possible mechanisms and incentives for water transfer and makes recommendations as to the feasibility and viability of alternatives for addressing equity issues. Present the report and recommendations to the Policy Management Committee, the Technical Advisory Committee, and the Southeast Regional Planning Commission.

1.9 Sabine Lake Salinity Analysis

This task analyzes quantitative impacts to the flow and salinity patterns within Sabine Lake resulting from a reduction of freshwater inflows, using a two-dimensional hydrodynamic simulation model.

1.9.1 Collect available historical monthly water level and salinity data on Sabine Lake. Obtain data from USGS, TNRCC, Sabine River Authority, and other sources. Compile historical inflow data on Sabine Lake, Sabine River and the Neches River compiled in Task 1.3.

1.9.2 Implement additional monitoring of water quality at five (5) sites that will complement existing tide gage, meteorology and water quality monitoring in the Sabine Lake study area. Possible sites include Sabine River near Orange, Neches River near Beaumont, Black Bayou near upper Sabine Lake, Johnson Bayou or Greens Bayou near lower Sabine Lake, and one offshore boundary station in the neritic waters of the Gulf of Mexico. All sites selected will be mutually agreeable to the contracting parties and will be monitored continuously for at least six months.

1.9.3 Apply the TxBLEND two-dimensional hydrodynamic and conservative mass (salinity) transport model to the Sabine Lake study area. This task includes creating and testing the computational grid, calibrating the model to specified conditions, and compiling input data on tidal flows, freshwater inflows, winds, and related information needed to perform model runs. TWDB will assist the contractor with technology and data transfer for the modeling task.

1.9.4 Perform hydrodynamic modeling of the estuary's circulation and salinity patterns under current conditions, as well as potential future conditions of interest to the decision-makers. The potential future conditions will be based on alternative water use scenarios developed through the Trans-Texas Water Program and approved for further impact analysis. This task will focus on changes in estuary's salinity gradient that could occur with changes in the freshwater inflow regime.

1.9.5 Prepare a draft technical memorandum documenting the objectives, methods, results and conclusions of the study. Document details of the model calculations and assumptions, parameters subject to calibration, calibration runs, and any other relevant technical data. Meet with the PMC and TAC to present the results, address comments, and create a final technical memorandum.

1.9.6 Continue monitoring of water quality at five (5) sites that will complement existing tide gage, meteorology and water quality monitoring in the Sabine Lake study area. The sites include Sabine River near Orange, Neches River near Beaumont, Black Bayou near upper Sabine Lake, Johnson Bayou, and one offshore boundary station in the neritic waters of the Gulf of Mexico. All sites will be monitored continuously through March 31, 1998.

2.0 WATER CONSERVATION

The water conservation effort for the Trans-Texas Water Program will utilize, as baseline data, the City of Houston's Water Conservation and Reservoir Systems Operation Plan. The Trans-Texas Program's conservation task provides a means to communicate the recommendations of the City of Houston effort throughout the Southeast Area.

2.1 Water Demand Projections

Revise the Consensus Planning water demand values for each Trans-Texas Program study year for the Houston area using the demand projections developed by the City of Houston as a result of their Water Conservation and Reservoir Systems Operation Plan.

2.2 Water Conservation Task Force

2.2.1 The TTWP Southeast Area Policy Management Committee will appoint a Water Conservation Task Force which will develop recommendations for consideration by the Southeast PMC. Consultant will:

a. Identify for consideration the primary water supply and water use entities in the Houston SMSA which could serve as potential members.

b. Assist the Water Conservation Task Force in implementation of objectives which may include development of:

- An interagency agreement among Task Force members which sets forth a Houston Area Water Conservation Program.

- An ongoing body to review and update this program.

2.2.2 Provide technical and meeting support for the Task Force.

3.0 WASTEWATER RECLAMATION

This task consists of analyzing the concept of utilizing reclaimed wastewater from the City of Houston's Sims Bayou and 69th Street Wastewater Treatment Plants by Coastal Water Authority (CWA) industrial customers located on State Highway 225. The objective of the task will be to create a detailed conceptual plan to provide reclaimed wastewater to CWA customers by utilizing segments of the existing CWA "B-1" transmission main and further evaluate the feasibility of that plan.

3.1 Conceptual Planning

3.1.1 Determine the projected industrial process and cooling water demands of the approximately 30 CWA customers located adjacent to State Highway 225, including allowance for possible new customers. Average and peak water use estimates for the entire S.H. 225 corridor will be projected at ten year increments from 1990 to 2050.

3.1.2 Determine the projected effluent discharges from the Sims Bayou and 69th Street WWTP's for each study year.

3.1.3 Develop two alternative conceptual facility plans for industrial customer use of reclaimed wastewater based on converting the existing CWA B-1 raw water main into a reclaimed wastewater main.

- Alternative 1 - Blend reclaimed wastewater with treated surface water from the East Water Treatment Plant to provide process and cooling water needs.

Convey this water through the B-1 main. Provide potable water through groundwater wells.

- Alternative 2 - Convey reclaimed wastewater through the B-1 main for cooling water purposes. Provide process and potable water needs through extension of the 42-inch potable water main parallel to the Southern Pacific Railroad right-of-way north of S.H. 225, or another alternative method.

The conceptual facility plans will include location and capacity sizing of transmission mains (raw water, potable, and reclaimed), storage reservoirs, treatment facilities and transfer pump stations.

3.1.4 For each of the above alternative plans, develop an implementation schedule for conversion and expansion of the reclaimed water system at ten-year increments. The implementation schedule will compare the available reclaimed wastewater supply versus industrial water demand needs.

3.1.5 Analyze the impacts, of converting the CWA B-1 main into a reclaimed wastewater main, on the raw water supply facilities for the East Water Purification Plant. This analysis includes:

- Analyze the maximum raw water supply hydraulic capability of the Lake Houston West Canal and the CWA Northwest Lateral under average and peak water delivery conditions.

- Compare and contrast the existing City of Houston water rights permits to the reconfigured raw water delivery system.

- Determine the treatment process impacts of mixing revised volumes of San Jacinto and Trinity River water based on existing conditions and future conditions.

- Discuss any impacts of the revised recommended raw water delivery system on raw water system operation, reliability, and on solids production, treatment and disposal.

3.2 Water Quality Evaluation

3.2.1 Collect available data on:

- influent water quality standards for cooling and process water of the S.H. 225 industry.

- current wastewater reuse standards of TNRCC.
- onsite industry water treatment processes.
- existing 69th Street and Sims Bayou WWTP effluent quality.
- existing East Water Treatment Plant (WTP) finished water quality.

3.2.2 Determine additional water quality treatment requirements for:

- Blended reclaimed water for process and cooling water use.
- Reclaimed water for cooling water use.

3.2.3 Analyze how the additional water quality treatment requirements can be achieved at the following locations:

- East WTP process modifications.
- 69th Street and Sims Bayou WWTP process modifications.
- Treatment process enhancements at an intermediate pumping and storage facility.

3.3 Environmental Review

3.3.1 Acquire data on the existing instream flow and water quality characteristics of the segments of Buffalo Bayou, Sims Bayou and Galveston Bay that are affected by the effluent discharges of the 69th Street and Sims Bayou WWTPs.

3.3.2 Collect data on aquatic species and communities in the affected portions of Buffalo Bayou, Sims Bayou and Galveston Bay.

3.3.3 Estimate the changes in effluent quality and quantity over the planning period resulting from wastewater reclamation and re-use according to the Alternative 1 and Alternative 2 conceptual plans.

3.3.4 Review the potential impacts (beneficial or adverse) of reduced stream flows in affected sections of Buffalo Bayou and Sims Bayou and to Galveston Bay on water quality, aquatic biota, threatened and endangered species, commercial and recreational interests.

3.4 Conceptual Plan Cost

3.4.1 Calculate the capital and operation and maintenance cost of each alternative for each study decade. Costs will include:

- Facility construction.
- Treatment plant process modification.
- Environmental mitigation, if required.

3.5 Report

3.5.1 Prepare a draft memorandum report containing the findings of the above studies and submit to the Southeast PMC and TAC for review.

3.5.2 Revise the draft report to reflect comments received and submit a final draft copy to the Southeast PMC and TAC.

5.1.15 Respond to comments from the PMC and TAC and prepare a final memorandum report on Allens Creek Reservoir.

5.2 Neches River Salt Water Barrier

5.2.1 Meet with the U.S. Army Corps of Engineers (USACOE) to discuss their on-going studies of the proposed permanent salt water barrier.

5.2.2 Meet with the LNVA to review the results of the hydrologic/yield studies of the salt water barrier being conducted separately from the TTWP.

5.2.3 Meet with interested parties to discuss environmental concerns for the salt water barrier. Input will be sought from the following:

- Southeast Area TAC members
- TNRCC
- TPWD
- USFWS
- NMFS
- National Park Service (NPS)-Big Thicket National Preserve
- LNVA
- TWDB
- USACOE

5.2.4 Perform a field reconnaissance of the salt water barrier site to investigate wetlands, bottomland hardwoods, aquatic and terrestrial habitat, endangered and threatened species, recreation, and other factors.

5.2.5 Develop estimated costs for mitigation of environmental and cultural resources impacts of the project. Develop an updated cost estimate for the barrier.

5.2.6 Based primarily on previous USACOE studies, prepare a preliminary analysis of the impact of the Neches salt water barrier on in-stream flows and inflows to bays and estuaries.

5.2.7 Based primarily on previous USACOE studies, prepare a preliminary environmental impact analysis for the permanent Neches salt water barrier covering wetlands, bottomland hardwoods, terrestrial and aquatic habitat, endangered and threatened species, fisheries, cultural resources, the Big Thicket National Preserve, recreation, aesthetic and visual resources, and other factors.

5.2.8 Make a preliminary assessment of the impact on Sabine Lake estuary system of construction of locks in the ship channel. Consider the following aspects:

- possible location
- institutional requirements
- environmental impacts and benefits

- possible impact on Neches River salinity
- impacts on navigation
- impact on localized flooding

Assess whether or not this alternative is worthy of further analysis.

5.2.9 Prepare a draft memorandum report covering the studies described above for the Neches River Salt Water Barrier and existing information on the project.

5.2.10 Review the draft report with the Southeast PMC and TAC.

5.2.11 Respond to comments from the PMC and TAC and prepare a final memorandum report on the permanent Neches River Salt Water Barrier.

5.2.12 Meet with the USACOE to discuss their recently investigated Site 6 location for the permanent salt water barrier.

5.2.13 Perform an additional field reconnaissance to investigate environmental conditions at Site 6.

5.2.14 Develop an updated cost estimate for a salt water barrier project at Site 6.

5.2.15 Incorporate the results of the investigations of Site 6 into the report described in subtask 5.2.9.

6.0 INTERBASIN TRANSFERS

6.1 Potential Transfer Route Analysis

6.1.1 Compile a list of the available environmental data on potential interbasin transfer routes. Mail or deliver the list to local, regional, state, and federal agencies, with a request for additional data and recommendations on other sources of information.

6.1.2 Collect and review additional environmental data including available aerial and satellite photography from state agencies.

6.1.3 Based on the available data, conduct a screening of the potential routes. The screening should consider available data on:

- Geology
- Topography
- In-stream impacts
- Endangered and threatened species
- Wildlife habitat (including bottomland hardwoods)
- Wetlands
- Fisheries

- Recreation
- Prime farmland
- Known historic and archaeological sites
- Public lands

Based on this screening, select a single route for a conceptual analysis of costs and environmental impacts.

6.1.4 Prepare a draft memorandum report describing the screening process and presenting a conceptual route.

6.1.5 Review the draft memorandum report with the Southeast PMC and TAC:

6.1.6 Respond to comments from the PMC and TAC and prepare a final memorandum report.

6.2 Conceptual Route Analysis

6.2.1 Develop a conceptual design for the route, including right-of-way requirements.

6.2.2 Develop a reconnaissance level construction cost estimate for the route.

6.2.3 Develop a preliminary assessment of possible water losses along the route.

6.2.4 Compile and assess additional environmental data on this route. Develop and discuss potential mitigative measures for environmental impacts.

6.3 Report

6.3.1 Prepare a draft report discussing the result of the conceptual analysis.

6.3.2 Review the draft report with the Southeast PMC and TAC.

6.3.3 Respond to comments from the PMC and TAC and prepare a final report.

7.0 CONTRACTUAL TRANSFERS

Four specific contractual water transfer alternatives will be investigated to determine their possible feasibility.

7.1 Gulf Coast Water Authority/Brazos

This contractual transfer opportunity consists of replacing existing GCWA Brazos River water with other available surface water supplies and requires construction of new conveyance facilities.

7.1.1 Determine the total quantity of supply that GCWA customers are projected to need from the GCWA storage reservoir on State Highway 146.

This contractual transfer opportunity consists of replacing Trinity River water owned by the City of Houston or TRA with other available surface water supplies.

7.3.1 For each decade, define the future volumes of Lake Livingston water which are diverted and used in southern Liberty and Chambers counties.

7.3.2 Determine the required capacity, implementation schedule, and preliminary cost estimate for the required conveyance facilities.

7.3.3 Conduct interviews with the City of Houston and TRA to determine the viability of this alternative. This interview will focus on the engineering, institutional, financial, and legal aspects of this plan.

7.3.4 Prepare a draft memorandum report describing the findings of this study and review the report with the Southeast PMC and TAC.

7.4 Irrigation Transfers

This task includes analysis of the feasibility, implementation requirements, and associated impacts of contractually transferring irrigation water supplies from the following nine (9) entities to meet municipal and industrial needs:

- Richmond Irrigation Company/Houston Lighting & Power
- Chocolate Bayou Water Company
- GCWA
- Chambers-Liberty Counties Navigation District
- Dayton Canal Company
- Trinity Water Reserve, Inc.
- TRA
- LNVA
- SRA

7.4.1 Determine the projected irrigation water supply requirements for each of the above entities for each future study year through 2050.

7.4.2 Analyze the reliability of each water right for potential use for municipal and manufacturing use. This analysis will include:

- determination of impact on more senior water rights holders
- review and comment by TNRCC staff
- assessment of future in-basin or out-of-basin use
- impact of the proposed transfer on downstream aquatic and terrestrial habitats

7.4.3 Conduct a survey of each entity to determine their willingness to consider contractual transfer of their existing water supplies. The survey will focus on legal, institutional, and financial issues including:

- Sellers price of water
- Permit issues
- Administrative costs
- Transfer schedule
- Water rights impacts
- Quantity of transferred rights
- Reliability of supplies
- Land Fallowing

7.4.4 Create a schedule of potential water transfers for each study year based on the above information.

7.4.5 Evaluate the environmental impacts of the potential contractual transfer of each alternative, including impacts to water quality and instream flows, wetlands and bottomland hardwood forests, wildlife resources and aquatic biota, endangered and threatened species, species of commercial and recreational value and socioeconomic and community values related to water resources.

7.4.6 Prepare a draft memorandum report summarizing the findings of this study and review the report with the Southeast PMC or TAC.

8.0 TRANS-TEXAS WATER PROGRAM FINAL REPORT

This report will compile all of the previously completed TTWP tasks into a final document. This report will summarize the technical results of each of the completed Trans-Texas reports, discuss the relationship between various studies, and present conclusions associated with the entire Trans-Texas Water Program for both the Southeast Area and the entire Trans-Texas Water Program area.

8.1.1 Prepare a draft memorandum report summarizing the TTWP. The report will be structured into the following sections:

- Introduction- Discussion of TTWP goals, objectives and strategy.
- Management- Discussion of organizational structure and public participation
- Technical Analysis- Summary of the nineteen separate technical studies and conclusions regarding the interrelationship between the various studies.
- Texas Water Plan- Discussion of the relationship between the Trans-Texas planning effort and the Senate Bill 1 planning effort.
- Conclusion- Discussion of accomplishments of the TTWP, and of issues requiring further study.

8.1.2 Review the draft memorandum report with the Southeast PMC and TAC, respond to comments from the PMC and TAC, and prepare a final memorandum report.

- Blended reclaimed water for process and cooling water use.
- Reclaimed water for cooling water use.

3.2.3 Analyze how the additional water quality treatment requirements can be achieved at the following locations:

- East WTP process modifications.
- 69th Street and Sims Bayou WWTP process modifications.
- Treatment process enhancements at an intermediate pumping and storage facility.

3.3 Environmental Review

3.3.1 Acquire data on the existing instream flow and water quality characteristics of the segments of Buffalo Bayou, Sims Bayou and Galveston Bay that are affected by the effluent discharges of the 69^{th} Street and Sims Bayou WWTPs.

3.3.2 Collect data on aquatic species and communities in the affected portions of Buffalo Bayou, Sims Bayou and Galveston Bay.

3.3.3 Estimate the changes in effluent quality and quantity over the planning period resulting from wastewater reclamation and re-use according to the Alternative 1 and Alternative 2 conceptual plans.

3.3.4 Review the potential impacts (beneficial or adverse) of reduced stream flows in affected sections of Buffalo Bayou and Sims Bayou and to Galveston Bay on water quality, aquatic biota, threatened and endangered species, commercial and recreational interests.

3.4 Conceptual Plan Cost

3.4.1 Calculate the capital and operation and maintenance cost of each alternative for each study decade. Costs will include:

- Facility construction.
- Treatment plant process modification.
- Environmental mitigation, if required.

3.5 Report

3.5.1 Prepare a draft memorandum report containing the findings of the above studies and submit to the Southeast PMC and TAC for review.

3.5.2 Revise the draft report to reflect comments received and submit a final draft copy to the Southeast PMC and TAC.

4.0 SYSTEM OPERATION

This task is defined assuming that the TTWP will utilize the background data and results of the City of Houston's Water Conservation and Reservoir Systems Operation Plan study. Following review and analysis of the City of Houston's reservoir systems operation study, the scope and budget for this task may require renegotiation.

4.1 Basic Data

4.1.1 Meet with staff of the San Jacinto River Authority (SJRA) and the City of Houston to discuss current operation of Lake Conroe and Lake Houston, previous yield and operation studies, constraints on system operation, and available data.

4.1.2 Review available hydrologic data for the lakes, including reservoir inflows, evaporation, area-capacity relationships, and sedimentation.

4.1.3 Develop additional data, if needed.

4.1.4 Review operation studies of currently permitted operation of the individual sources without system operation to determine yield, reservoir elevations, and downstream flows.

4.2 San Jacinto Basin Projects

4.2.1 Obtain and review system operation studies for the San Jacinto Basin project conducted for the City of Houston.

4.2.2 Review the impact of system operation conducted for Houston on yield, downstream flows, and reservoir elevations.

4.3 San Jacinto Basin Projects and Lake Livingston

4.3.1 Meet with the Trinity River Authority (TRA) and the City of Houston to discuss current operation of Lake Livingston, previous yield and operation studies, constraints on system operation and available data.

4.3.2 Review available hydrologic data for Lake Livingston, including reservoir inflows, evaporation, area-capacity relationship, and sedimentation. Develop additional data, if needed.

4.3.3 Develop a computer model to simulate operation of the San Jacinto Basin Projects in conjunction with water from Lake Livingston.

4.3.4 Conduct an operation study for Lake Livingston operating under its existing permit.

4.3.5 Conduct operation studies to determine the potential gain in yield from operating Lake Livingston and the San Jacinto Basin projects as a system.

4.3.6 Review the impact of the system operations in Task 4.3.3 on yield, downstream flows, and reservoir elevations.

4.3.7 Develop preliminary estimates of the cost of facilities and operation required for system operation.

4.4 Environmental Review

4.4.1 Review the potential environmental, social, and economic impacts of reservoir system operation. Possible impacts of system operation include the following:

- Lake levels.
- Instream flows and flows to bays and estuaries.
- Recreational use of lakes and streams.
- Associated impacts on aquatic and terrestrial habitat.
- Associated socio-economic impacts.

4.4.2 Describe water rights, facility, and operation changes needed to achieve the benefits of system operation.

4.5 Sediment Removal and Disposal

Use Lake Livingston and Lake Houston as typical existing projects to review the concept of providing additional water supply by removing and disposing of sediment from existing reservoirs.

4.5.1 Based on available data, estimate sediment deposition in the reservoirs and area and capacity characteristics as of 1995 and 2030.

4.5.2 Conduct operation studies to determine the impact of sedimentation on reservoir yields.

4.5.3 Estimate the gain in yield from removing and disposing of sediment deposited in the reservoirs to improve area and capacity characteristics.

4.5.4 Based on available information, make a preliminary estimate of the cost of removing and disposing of sediment from these reservoirs. Develop an estimated unit cost for the yield provided by sediment removal and disposal.

4.5.5 Conduct a preliminary review of the environmental impacts of sediment removal and disposal. Include a qualitative assessment of the biologic, chemical, and toxicological quality of reservoir sediments. Discuss the environmental permitting considerations associated with the removal and disposal of reservoir sediments.

4.6 Report

4.6.1 Prepare a draft memorandum report describing the system operation and sediment removal studies and provide conclusions and recommendations regarding incorporation of these methods into the TTWP for the Southeast Area.

4.6.2 Review the draft report with the Southeast PMC and TAC.

4.6.3 Respond to comments from the PMC and TAC and prepare a final memorandum report on system operation and sediment removal.

5.0 NEW SURFACE WATER PROJECTS

5.1 Allens Creek Reservoir

5.1.1 Obtain and review previous studies and analyses of Allens Creek Reservoir.

5.1.2 Meet with TPWD, TNRCC, TWDB, National Marine Fisheries Service (NMFS), Fish and Wildlife Service (FWS), and consultants from the West-Central Area to review environmental studies at the Allens Creek site.

5.1.3 Conduct a field reconnaissance of the Allens Creek site, including the following elements:

- Wetlands evaluation including field check of habitat values and acreage.
- Terrestrial/aquatic habitat evaluations.
- Threatened and endangered species evaluation.

5.1.4 Conduct water quality routing analysis for 50-year period of record to estimate average and drought TDS and Chlorides concentrations in the reservoir.

5.1.5 Analyze the yield of Allens Creek Reservoir with 40 percent and 80 percent of capacity thresholds for pass-through of inflows.

5.1.6 Make a preliminary analysis of the impact of Allen's Creek Reservoir on in-stream flows, flows to bays and estuaries, and water quality.

5.1.7 Make a preliminary analysis of the impact of Allens Creek Reservoir on terrestrial and aquatic habitat, wetlands, fisheries, and threatened and endangered species.

5.1.8 Discuss the impact of Allens Creek Reservoir on cultural and historical resources.

5.1.9 Make a preliminary analysis of Allens Creek Reservoir on aesthetic and visual resources and recreation.

5.1.10 Review the benefits and environmental impacts of operating Allens Creek Reservoir as a balancing reservoir in the Trans-Texas system.

5.1.11 Estimate the cost for mitigation of environmental and archeological impacts of the Allens Creek project.

5.1.12 Develop an updated cost estimate for development of Allens Creek Reservoir.

5.1.13 Prepare a draft memorandum report covering the studies described above for Allens Creek Reservoir and existing information on the project.

5.1.14 Review the draft report with the Southeast PMC and TAC.

5.1.15 Respond to comments from the PMC and TAC and prepare a final memorandum report on Allens Creek Reservoir.

5.2 Neches River Salt Water Barrier

5.2.1 Meet with the U.S. Army Corps of Engineers (USACOE) to discuss their on-going studies of the proposed permanent salt water barrier.

5.2.2 Meet with the LNVA to review the results of the hydrologic/yield studies of the salt water barrier being conducted separately from the TTWP.

5.2.3 Meet with interested parties to discuss environmental concerns for the salt water barrier. Input will be sought from the following:

- Southeast Area TAC members
- TNRCC
- TPWD
- USFWS
- NMFS
- National Park Service (NPS)-Big Thicket National Preserve
- LNVA
- TWDB
- USACOE

5.2.4 Perform a field reconnaissance of the salt water barrier site to investigate wetlands, bottomland hardwoods, aquatic and terrestrial habitat, endangered and threatened species, recreation, and other factors.

5.2.5 Develop estimated costs for mitigation of environmental and cultural resources impacts of the project. Develop an updated cost estimate for the barrier.

5.2.6 Based primarily on previous USACOE studies, prepare a preliminary analysis of the impact of the Neches salt water barrier on in-stream flows and inflows to bays and estuaries.

5.2.7 Based primarily on previous USACOE studies, prepare a preliminary environmental impact analysis for the permanent Neches salt water barrier covering wetlands, bottomland hardwoods, terrestrial and aquatic habitat, endangered and threatened species, fisheries, cultural resources, the Big Thicket National Preserve, recreation, aesthetic and visual resources, and other factors.

5.2.8 Make a preliminary assessment of the impact on Sabine Lake estuary system of construction of locks in the ship channel. Consider the following aspects:

- possible location
- institutional requirements
- environmental impacts and benefits

- possible impact on Neches River salinity
- impacts on navigation
- impact on localized flooding

Assess whether or not this alternative is worthy of further analysis.

5.2.9 Prepare a draft memorandum report covering the studies described above for the Neches River Salt Water Barrier and existing information on the project.

5.2.10 Review the draft report with the Southeast PMC and TAC.

5.2.11 Respond to comments from the PMC and TAC and prepare a final memorandum report on the permanent Neches River Salt Water Barrier.

5.2.12 Meet with the USACOE to discuss their recently investigated Site 6 location for the permanent salt water barrier.

5.2.13 Perform an additional field reconnaissance to investigate environmental conditions at Site 6.

5.2.14 Develop an updated cost estimate for a salt water barrier project at Site 6.

5.2.15 Incorporate the results of the investigations of Site 6 into the report described in subtask 5.2.9.

6.0 INTERBASIN TRANSFERS

6.1 Potential Transfer Route Analysis

6.1.1 Compile a list of the available environmental data on potential interbasin transfer routes. Mail or deliver the list to local, regional, state, and federal agencies, with a request for additional data and recommendations on other sources of information.

6.1.2 Collect and review additional environmental data including available aerial and satellite photography from state agencies.

6.1.3 Based on the available data, conduct a screening of the potential routes. The screening should consider available data on:

- Geology
- Topography
- In-stream impacts
- Endangered and threatened species
- Wildlife habitat (including bottomland hardwoods)
- Wetlands
- Fisheries

- Recreation
- Prime farmland
- Known historic and archaeological sites
- Public lands

Based on this screening, select a single route for a conceptual analysis of costs and environmental impacts.

6.1.4 Prepare a draft memorandum report describing the screening process and presenting a conceptual route.

6.1.5 Review the draft memorandum report with the Southeast PMC and TAC:

6.1.6 Respond to comments from the PMC and TAC and prepare a final memorandum report.

6.2 Conceptual Route Analysis

6.2.1 Develop a conceptual design for the route, including right-of-way requirements.

6.2.2 Develop a reconnaissance level construction cost estimate for the route.

6.2.3 Develop a preliminary assessment of possible water losses along the route.

6.2.4 Compile and assess additional environmental data on this route. Develop and discuss potential mitigative measures for environmental impacts.

6.3 Report

6.3.1 Prepare a draft report discussing the result of the conceptual analysis.

6.3.2 Review the draft report with the Southeast PMC and TAC.

6.3.3 Respond to comments from the PMC and TAC and prepare a final report.

7.0 CONTRACTUAL TRANSFERS

Four specific contractual water transfer alternatives will be investigated to determine their possible feasibility.

7.1 Gulf Coast Water Authority/Brazos

This contractual transfer opportunity consists of replacing existing GCWA Brazos River water with other available surface water supplies and requires construction of new conveyance facilities.

7.1.1 Determine the total quantity of supply that GCWA customers are projected to need from the GCWA storage reservoir on State Highway 146.

7.1.2 Determine the necessary water conveyance facilities to accomplish this plan including expansion of the CWA facilities, if required, and construction of new facilities linking the CWA system with the GCWA storage reservoir. Develop a preliminary cost estimate and implementation schedule for the new conveyance facilities.

7.1.3 Evaluate the environmental consequences of this alternative including impacts to water quality and instream flows, wetlands and bottomland hardwood forests, wildlife resources and aquatic biota, endangered and threatened species, species of commercial and recreational value and socioeconomic and community values related to water resources.

7.1.4 Conduct interviews with the GCWA, CWA, and BRA to help determine the feasibility of this alternative. The interview will focus on the engineering, institutional, financial and legal aspects of this plan.

7.1.5 Prepare a draft memorandum report describing the findings of this study and review the report with the Southeast PMC and TAC.

7.2 City of Houston/San Jacinto

This contractual transfer opportunity consists of replacing existing City of Houston-owned Lake Conroe water which is diverted from Lake Houston with other available surface water supplies.

7.2.1 For each decade, tabulate the quantity of surface water

- Required for Montgomery County and future SJRA needs.
- Available from Lake Conroe from SJRA water rights.
- Resulting shortage from Lake Conroe to be supplied from City of Houston water rights considered for contractual transfer.

7.2.2 Determine a conveyance system capacity, location and conceptual cost estimate to facilitate this transfer.

7.2.3 Evaluate the environmental consequences of this alternative including impacts to water quality and instream flows, wetlands and bottomland hardwood forests, wildlife resources and aquatic biota, endangered and threatened species, species of commercial and recreational value and socioeconomic and community values related to water resources.

7.2.4 Conduct interviews with the City of Houston and SJRA to determine the feasibility of this alternative. These interviews will focus on the engineering, institutional, financial, and legal aspects of this plan.

7.2.5 Prepare a draft memorandum report describing the findings of this study and review the report with the Southeast PMC and TAC.

7.3 City of Houston and Trinity River Authority/Trinity

This contractual transfer opportunity consists of replacing Trinity River water owned by the City of Houston or TRA with other available surface water supplies.

7.3.1 For each decade, define the future volumes of Lake Livingston water which are diverted and used in southern Liberty and Chambers counties.

7.3.2 Determine the required capacity, implementation schedule, and preliminary cost estimate for the required conveyance facilities.

7.3.3 Conduct interviews with the City of Houston and TRA to determine the viability of this alternative. This interview will focus on the engineering, institutional, financial, and legal aspects of this plan.

7.3.4 Prepare a draft memorandum report describing the findings of this study and review the report with the Southeast PMC and TAC.

7.4 Irrigation Transfers

This task includes analysis of the feasibility, implementation requirements, and associated impacts of contractually transferring irrigation water supplies from the following nine (9) entities to meet municipal and industrial needs:

- Richmond Irrigation Company/Houston Lighting & Power
- Chocolate Bayou Water Company
- GCWA
- Chambers-Liberty Counties Navigation District
- Dayton Canal Company
- Trinity Water Reserve, Inc.
- TRA
- LNVA
- SRA

7.4.1 Determine the projected irrigation water supply requirements for each of the above entities for each future study year through 2050.

7.4.2 Analyze the reliability of each water right for potential use for municipal and manufacturing use. This analysis will include:

- determination of impact on more senior water rights holders
- review and comment by TNRCC staff
- assessment of future in-basin or out-of-basin use
- impact of the proposed transfer on downstream aquatic and terrestrial habitats

7.4.3 Conduct a survey of each entity to determine their willingness to consider contractual transfer of their existing water supplies. The survey will focus on legal, institutional, and financial issues including:

- Sellers price of water
- Permit issues
- Administrative costs
- Transfer schedule
- Water rights impacts
- Quantity of transferred rights
- Reliability of supplies
- Land Fallowing

7.4.4 Create a schedule of potential water transfers for each study year based on the above information.

7.4.5 Evaluate the environmental impacts of the potential contractual transfer of each alternative, including impacts to water quality and instream flows, wetlands and bottomland hardwood forests, wildlife resources and aquatic biota, endangered and threatened species, species of commercial and recreational value and socioeconomic and community values related to water resources.

7.4.6 Prepare a draft memorandum report summarizing the findings of this study and review the report with the Southeast PMC or TAC.

8.0 TRANS-TEXAS WATER PROGRAM FINAL REPORT

This report will compile all of the previously completed TTWP tasks into a final document. This report will summarize the technical results of each of the completed Trans-Texas reports, discuss the relationship between various studies, and present conclusions associated with the entire Trans-Texas Water Program for both the Southeast Area and the entire Trans-Texas Water Program area.

8.1.1 Prepare a draft memorandum report summarizing the TTWP. The report will be structured into the following sections:

- Introduction- Discussion of TTWP goals, objectives and strategy.
- Management- Discussion of organizational structure and public participation
- Technical Analysis- Summary of the nineteen separate technical studies and conclusions regarding the interrelationship between the various studies.
- Texas Water Plan- Discussion of the relationship between the Trans-Texas planning effort and the Senate Bill 1 planning effort.
- Conclusion- Discussion of accomplishments of the TTWP, and of issues requiring further study.

8.1.2 Review the draft memorandum report with the Southeast PMC and TAC, respond to comments from the PMC and TAC, and prepare a final memorandum report.

10.0 PUBLIC PARTICIPATION ASSISTANCE

An increased level of public participation is desired for Phase II of the program, including the identification of interested parties and public issues of concern, enlarging the Technical Advisory Committee membership, and improving communication methods. The consultant will assist the Southeast PMC in achieving this increased level of participation as follows:

10.1 Public Issues Identification

10.1.1 Identify groups and individuals with special interests in the TTWP.

10.1.2 Characterize the issues and concerns of these interested parties affecting the TTWP Southeast.

10.1.3 Categorize "target" populations based upon issues of concern.

10.1.4 Identify ways to resolve or ameliorate these concerns during the planning process.

10.1.5 Prepare a memorandum for the PMC and TAC: identifying the individuals and groups ("target" populations) with special interest in Southeast TTWP; characterizing their issues and concerns relative to the Southeast TTWP; and identifying possible methods of resolving or ameliorating these concerns.

10.1.6 Conduct discussions with the public who have concerns or disputes about the TTWP and identify methods to address the issues.

10.2 Public Information

10.2.1 Using the products of Task 10.1.1 and 10.1.3, assist the PMC prepare and maintain a mailing list in computer-readable format for citizens and organizations in the Southeast Region, cross referenced by "target" populations, to receive public information publications including the quarterly TTWP newsletter and technical briefing papers on issues of concern.

10.2.2 Prepare text, graphics, and tables based on previously defined program deliverables for articles about Southeast region activities to be published in the quarterly TTWP newsletter and within technical briefing papers.

10.2.3 Prepare informational materials on various issues for distribution to the public upon request.

10.2.4 Assist the Southeast PMC in responding to requests for information.

10.2.5 Develop and initiate a "follow-up" procedure directly soliciting comments via mail or phone contact from "target" populations.

10.2.6 Review public comments and prepare a synopsis of requests and comments for review and possible action by the TAC.

10.2.7 Demonstrate responsiveness of the PMC to public comments and requests through summary reports for inclusion in the quarterly TTWP newsletter.

10.3 Committee Assistance

This task includes assisting the TTWP PMC, Southeast Area PMC, and Southeast Area TAC.

10.3.1 Attend up to eight (8) TTWP PMC and thirteen (13) Southeast Area PMC meetings. The purpose of this task is to assist the committees by providing technical information, discussing water issues with participants, and monitoring the program's progress.

10.3.2 Attend up to six (6) Southeast Area TAC meetings.

10.3.3 Attend up to twelve (12) Southeast Area public involvement meetings.

10.3.4 Develop exhibits, technical data, news articles, etc. to support each of the committees and the overall program.

11.0 PROJECT ADMINISTRATION

11.1 Contract Administration

11.1.1 Attend up to ten (10) project sponsor meetings to discuss the project status, technical initiatives, analysis methods, budget, etc. Prepare information, status updates, etc. for discussion for each meeting.

11.1.2 Attend up to four (4) project status meetings and provide technical input, as required, to coordinate the work efforts and results of the Southeast Area, with the West-Central and South-Central Area projects.

11.1.3 Prepare monthly information to illustrate progress of the project.

a. Prepare up to thirty (30) monthly progress reports and monthly billings which summarize the work completed through each work period. The monthly progress report will contain the following information:

- Major Phase II task names and description.
- Total manhours and cost budgeted for individual tasks.
- Percent of the tasks completed.
- Dollar value of the percent of the tasks completed.
- Total tasks completed, indicating the percent of and dollar value of the project completed.

b. Prepare and update schedules, budgets, and the work plan, as required, to illustrate the current project status.

11.2 Nonlabor Expenses

The following type of nonlabor expense are expected to be incurred in accomplishing the identified program tasks:

11.2.1 Travel - attendance at meetings and field investigations including hotel, meals, transportation, and associated miscellaneous expenses.

11.2.2 Reproduction - blueline, copying, and printing for reports, maps, and other exhibits.

11.2.3 Computer - expenses associated with use of computers for modeling, data and word processing, calculations, and other miscellaneous work.

11.2.4 Other - all other nonlabor expenses

Appendix B

TTWP Southeast Area
Technical Advisory Committee Members

First Name	Last Name	Representing
Alan	Allen	Sportsmen Conservationists of Texas
Larry	Armentor	Devers Canal Rice Producers, Inc.
Dede	Armentrout	National Audubon Society
Saul	Aronow	Golden Triangle Sierra Club
Larry	Banner	Citizen
Barbara	Barron	League Women Voters of Texas
Ragina	Bell	Citizen
Tony	Bennett	Citizen
David	Berkshire	Big Thicket Conservation Association
Janice	Bezanson	Texas Committee on Natural Resources
Carolyn	Bilski	Austin County
Bob	Bowman	Deep East Texas Development Assc.
Philip	Bowman	La. Dept. Wildlife & Fisheries
Don	Braddock	Citizen
Joe	Broadus	U.S. Geological Survey
J.	Brown	Jardin County
Marilyn	Browning	Galveston Bay National Estuary Program
Tom	Calnan	Coastal Coordination Council
Jimmie	Cokinos	Pct.1 Jefferson Co.
Dave	Cowen	US Forsest Service
Marty	Craig	GLO Coastal Liaison
Paul	Crutchfield	Chambers-Liberty Counties Navigation District
Kevin	Daniels	Gulf Coast Conservation Assoc.
Richard	Diehl	Association of Water Board Directors
Robert	Eckels	Harris County
Richard	Fernandez	City of Houston
Michael	Foster	South East Texas Regional Planning
Frances	Gelwick	Texas A&M University
Albert	Green	Texas Parks and Wildlife Department
Terry	Greer	Toledo Lake Assc.
Carl	Griffith	Jefferson County
Mike	Harbordt	Harris County Manufacturing Assc.
Richard	Harrel	Clean Air & Water Inc.
Duane	Hengst	Citizen
John	Hyden	Sabine County
Bill	Jackson	National Marine Fisheries Service
Maxine	Johnson	Big Thicket Conservation Assn.
John	Johnson	Jefferson County Judge
Jim	Kachtick	Greater Houston Partnership
Lloyd	Kirkham	Liberty County
Chester	Levy	TWCA Irrigation/ Drainage District Panel
Sarah	Loudermilk	Big Thicket Conservation Assn.
Gaylan	Lyon	Citizen
Jerry	Mambretti	Texas Parks and Wildlife Dept, Coastal
Brandt	Manchen	Sierra Club - Houston
Carl	Masterson	Houston-Galveston Area Council of Governments
Thomas	Mayfield	Hardin County

First Name	Last Name	Representing
Jerry	McCrory	U. S. Army Corps of Engineers: Ft. Worth
John	McDonald	Orange County
Ned	Meister	Texas Farm Bureau
Gordon	Meyers	Gulf Coast Water Authority
Bill	Moore	San Jacinto River Authority
Gary	Neighbors	Angelina & Neches River Authority
Ronald	Neighbors	Harris Galveston Coastal Subsidence Dist.
Oscar	Nelson	Chambers County
Fred	Ore	U. S. Bureau of Reclamation
Rafael	Ortega	Harris County
Catherine	Perrine	League Women Voters of Texas
John	Phillips	Citizen
Glenn	Phillips	Sabine River Authority
J.	Prestidge	Senator Carlos Truan's Office
Ronnie	Raum	U.S. Forest Service
Linda	Rhodes	Citizens Environmental Coalition
Lance	Robinson	Texas Parks and Wildlife Department
Ralph	Rundle	Coastal Water Authority
Todd	Running	Citizen
David	Rusk	Citizen
Jane	Saginaw	US EPA
Harold	Schild	Vidor
Cynthia	Schmidt	Houston Lighting & Power
Lon	Sharver	Newton County
Linda	Shead	Galveston Bay Foundation
Frank	Shipley	Galveston Bay National Estuary Program
Bruce	Sieve	Golden Triangle Sierra Club
Larry	Soward	Texas Department of Agriculture
Art	Spencer	Lower Neches Valley Authority
Terry	Stelly	Concerned Citizen
James	Stewart	Houston Audubon Society
Jim	Stokes	Beaumont Chamber of Commerce
Rick	Strahan	Big Thicket National Preserve
Wayne	Stupka	Coalition Advocating a Safe Environment
Rusty	Swafford	National Marine Fisheries Service
Melvin	Swoboda	Sabine River Authority
Edward	Tadlock	City of Houston
Jack	Tatum	Sabine River Authority
John	Thompson	Trinity River Authority
Robert	Van Hook	U.S. Army Corps of Engineers: Galveston
Danny	Vance	Trinity River Authority
Gary	Waits	Citizen
Floyd	Watson	Shelby County
S. A.	Webb	Beaumont
Fred	Werner	US Fish & Wildlife Service
Paul	Whitefield	National Parks Service, Big Thicket
Page	Williams	Houston Audubon

Appendix C

Trans-Texas Water Program Southeast Study Area
Program Committee Meetings Attended

No.	*Statewide PMC*	*Southeast PMC*	*Southeast TAC*
1	June 23, 1994	February 28, 1995	June 8, 1994
2	March 1, 1995	March 1, 1995	September 13, 1995
3	June 29, 1995	July 13, 1995	November 21, 1996
4	October 5, 1995	April 30, 1996	January 8, 1997
5	February 7, 1996	September 14, 1996	
6	August 3, 1996	November 21, 1996	
7	February 26, 1997	January 20, 1997	
8		February 26, 1997	
9		June 26, 1997	
10		September 18, 1997	

Other TTWP Associated Meetings Attended

No.	*Date*	*Group/Organization*	*Location*
1	October 13, 1994	Coastal Water Authority	Houston
2	March 1, 1995	Consultant Meeting	Austin
3	April 11, 1995	Louisiana Coordination	Baton Rouge, La.
4	April 19, 1995	League of Women Voters	Beaumont
5	July 19, 1995	SETRPC Executive Committee	Port Arthur
6	September 13, 1995	TAC Focus Groups	Beaumont
7	September 14, 1995	La-Tx Coordination	Baton Rouge, La.
8	September 27, 1995	TAC Environmental Focus Group	Houston
9	April 13, 1996	TAC Environmental Focus Group	Houston
10	April 29, 1996	TAC Environmental Focus Group	Houston
11	December 10, 1996	East Texas Legislative Briefing	Beaumont
12	January 9, 1997	Legislative Briefing	Houston

Appendix D

INTERVIEW CONCEPT FOR TRANS TEXAS PROGRAM

The following is a questioning sequence for the Trans-Texas program interviews. The basic approach is to divide the questioning into two general areas - program-wide and regional.

I. Program-Wide Questions

The basic idea is to determine the role/importance of the Sabine River water transfer in public attitudes about the TTWP. It is our intention to inquire into the "equity" issues and the "our water" issue that already has been expressed. The questioning will focus upon the following schematic diagram. (SEE SCHEMATIC 1.) The following is a proposed questioning sequence.

1. If there is no transfer of Sabine River water proposed as part of the Trans-Texas program, do you have any issues or concerns regarding the Trans-Texas program?

2. If there is transfer of Sabine River water proposed as part of the Trans-Texas program, but only within the southeast Texas region (e.g., to Houston area only), do you have any issues or concerns regarding the Trans-Texas program?

Follow-up questions - Try to delve into classes of concerns and methods to resolve these concerns. It is clearly anticipated that concerns will be voiced here regarding "fairness". It is extremely important to try to understand what the fairness issue really is and whether there are methods to address the issue. Further, there is a real necessity to understand conservation and other measures to achieve the most efficient use of water in light of this fairness concern. It would be excellent if we could gain information regarding the level of conservation and other measures that would be sufficient to offset fairness issues.

3. If there is transfer of Sabine River water proposed as part of the Trans-Texas program, and that transfer is proposed to serve both the Houston region and other regions of the state such as San Antonio and/or Corpus Christi, are there any issues or concerns that you have regarding the Trans-Texas program?

Follow-up questions - The important question here is whether there are unique issues or problems raised by the transfer further west that are not otherwise discussed in the answer to question 2. A likely issue here is the volume of transfer. In other words, will more water be removed from the Sabine if that water is being provided to both Houston and San Antonio, for instance. Again, the focus of the follow-up is to try to understand the class of issue and the ability of that issue to be resolved.

II. Regional Questions (to persons in the Sabine River Basin*)

The regional questions will start from the assumption that some volume of water is proposed to be transferred from the Sabine River to Houston and/or points west. The purpose of this round of questioning is to delve into some detail about the concerns and methods of resolving those concerns. A general goal of this proposed methodology is that to the extent more specific issues are identified in the program-wide section above, these specific issues would be picked up and explored in detail in this regional phase.

The regional questions are proposed to be asked utilizing the following diagram (SEE SCHEMATIC 2). The following is a sequence of questions regarding the diagram above.

1. Toledo Bend Reservoir

What concerns do you have about the transfer of water from the Sabine River as it relates to Toledo Bend reservoir?

Follow-ups as appropriate: (1) Identify yourself (and your interest) with regard to the usage of Toledo Bend Reservoir. (2) Would fluctuations in the shoreline be of concern to you? (3) Would the point of withdrawal of water be of concern to you if it were proposed to be within Toledo Bend reservoir? (4) Do you have any concern or even knowledge about hydro-electric power generation from Toledo Bend? (5) What is the magnitude of your concern? Can it be resolved by making changes? If so, what?

2. Sabine River

What concerns do you have about the transfer of water from the Sabine River as it relates to the Sabine River itself?

Follow-ups, as appropriate: (1) Identify yourself (and your interest) with regard to the usage of the Sabine River. (2) Do you have concerns about the point of withdrawal as it relates to the Sabine River? How so? (3) Are you concerned about base flow and peak flow issues? If so, why? (4) What are the magnitude of your concerns? Can they be resolved by making changes to the program? If so, what?

3. Sabine Lake

What concerns do you have about the transfer of water from the Sabine River as it relates to Sabine Lake?

Follow-ups, as appropriate: (1) Identify yourself (and your interest) with regard to the usage of Sabine Lake. (2) Probe into knowledge about freshwater inflow and salinity balance issues. (3) Is your goal the maintenance of the existing Sabine Lake ecological system or are you open to changes in the salinity regime? (4) Do you have faith in computer models associated with salinity? (5) Do you trust the modelers? (6) Would a lock on the Sabine/Neches waterway change your opinion of this program?

4. Transfer Pathways

[See alternative route map, Figure 6.1 from the Phase I report.]

What concerns do you have about the transfer of water from the Sabine River as it relates to the path and method of transfer?

Follow-ups, as appropriate: (1) Identify yourself (and your interest) with the transfer pathway. (2) What are the concerns about the habitat/Big Thicket issues? (3) What are your concerns about wetlands? (4) What are your concerns about endangered species? (5) What are your concerns about bottomland hardwood areas? (6) What other environmental concerns do you have? (7) What are your concerns about the intersection of the transfer and river systems? (8) What are your concerns about the community aspects of the transfer? (9) What are your concerns about flooding?

5. Regional Development

What are your concerns about the transfer of water from the Sabine River as it relates to regional development potential or loss thereof.

Follow-up questions: (1) Ask question regarding northern Sabine River watershed. (2) Ask question regarding lower Sabine/Neches watershed. (Clear concern is whether transfer will impede future economic growth). (3) Probe concern about water demand/water availability projections. What about the differences in water demand projections for the Southeast area?

6. Other follow-up questions.

Probe level of understanding regarding other measures to insure the most efficient use of water.
What type and amount of other measures are acceptable.
How much conservation is required.
What level of reclamation and/or reuse is acceptable.
What other measures are acceptable.

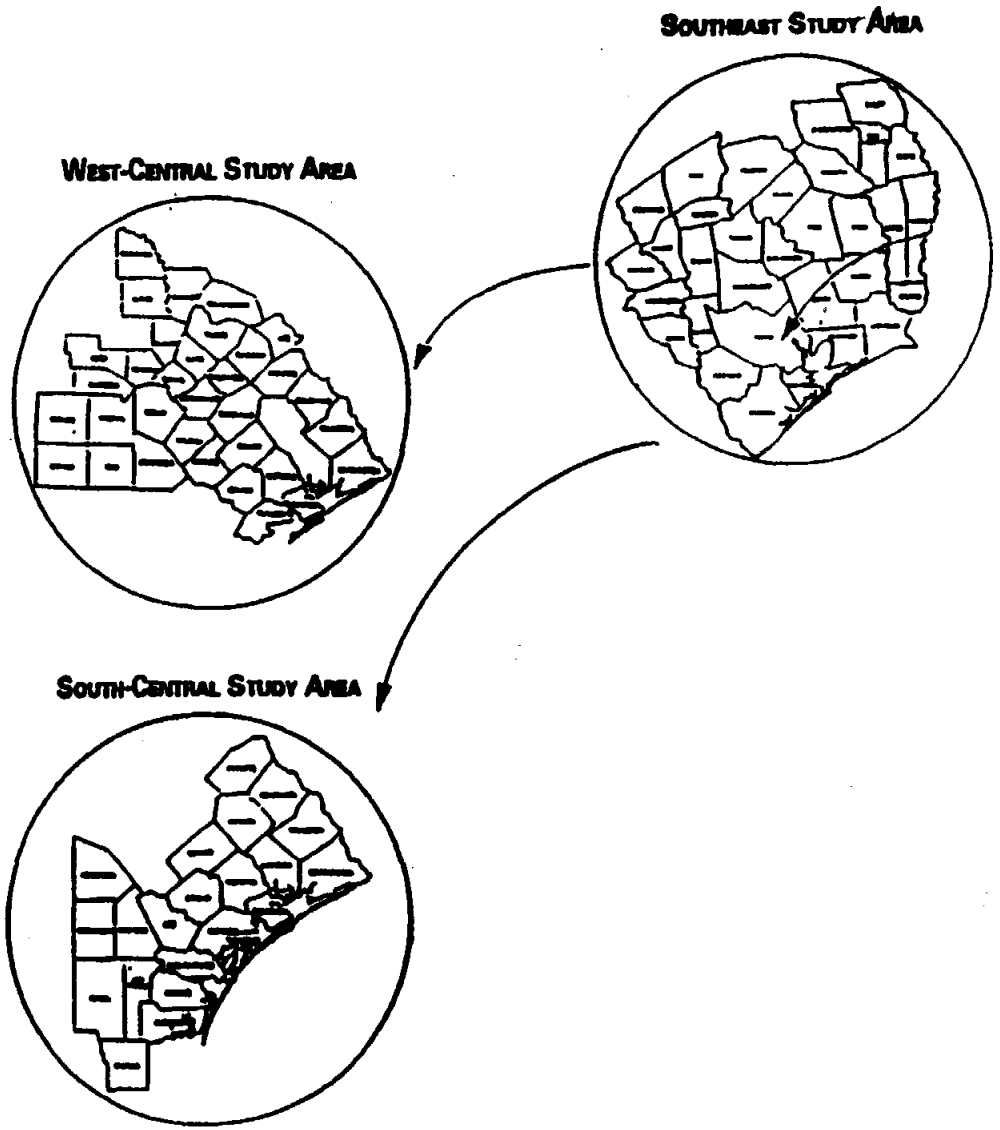
What is your understanding regarding the Neches Salt Water Barrier? Do you have concerns?
What is your understanding regarding other interbasin transfers? Do you have concerns?

III. Public Participation

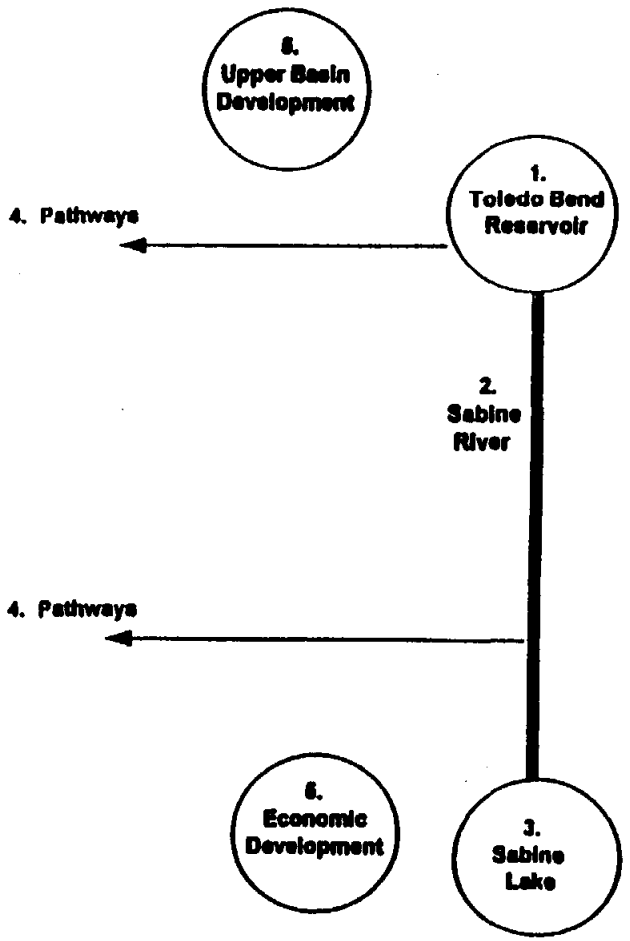
1. Do you feel TTWP public involvement has been good/bad/indifferent to date?
   What changes would you suggest?
2. Do you believe the information that you get? How would you like to get information. From whom?
3. Do you have suggestions for other persons we should interview?

TRANS-TEXAS WATER PROGRAM

Schematic 1



Schematic 2



Southeast Area Water Availability with Advanced Conservation Strategy[1]

Amount (Thousands of Acre/Feet-Year)

Category	*Sabine*	*Neches*	*Neches-Trinity*	*Trinity*	*Trinity-San Jacinto*	*San Jacinto*	*San Jacinto-Brazos*	*Brazos*	*Total Southeast*
2000									
In-Basin Demands	86.0	261.4	329.8	138.3	142.5	932.1	459.5	426.6	2776.3
In-Basin Supplies									
Groundwater	23.3	110.5	7.5	34.3	26.6	451.7	74.9	130.5	859.3
Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	488.2	4197.4
TOTAL	1213.7	957.4	7.5	1390.7	26.6	709.4	132.7	618.7	5056.7
Surface Water Transfers									
Imported Supplies	0.9	1.4	322.3	0.0	115.9	282.7	326.8	0.0	1050.1
Export Demands	1.4	280.7	0.0	559.2	0.0	60.0	0.0	148.694	1050.0
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**844.3**	**207.6**	**0.0**	**693.2**	**0.0**	**0.0**	**0.0**	**43.4**	**1788.5**
2010									
In-Basin Demands	93.9	275.4	316.5	140.5	146.6	995.4	488.0	462.0	2918.3
In-Basin Supplies									
Supplied by Groundwater	23.3	111.6	7.9	36.6	25.7	292.3	80.9	141.9	720.2
Supplied by Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	487.6	4196.8
TOTAL	1213.7	958.5	7.9	1393.0	25.7	550.0	138.7	629.5	4917.0
Surface Water Transfers									
Imported Supplies	1.0	2.0	308.6	0.0	120.9	505.4	349.3	0.0	1287.2
Export Demands	2.0	279.6	0.0	792.4	0.0	60.0	0.0	153.2	1287.1
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**835.9**	**196.4**	**0.0**	**460.1**	**0.0**	**0.0**	**0.0**	**14.3**	**1506.7**
2020									
In-Basin Demands	102.4	287.3	304.3	143.4	150.9	1081.9	516.2	490.6	3077.0
In-Basin Supplies									
Groundwater	23.3	112.8	8.3	38.7	31.1	251.1	87.1	156.1	708.5
Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	487.1	4196.3
TOTAL	1213.7	959.7	8.3	1395.1	31.1	508.8	144.9	643.2	4904.8
Surface Water Transfers									
Imported Supplies	1.0	2.6	296.0	0.0	119.8	633.1	371.3	0.0	1423.9
Export Demands	2.6	267.0	0.0	931.9	0.0	60.0	0.0	162.3	1423.8
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**826.8**	**199.0**	**0.0**	**319.8**	**0.0**	**0.0**	**0.0**	**-9.7**	**1335.8**

Amount (Thousands of Acre/Feet-Year)

Category	*Sabine*	*Neches*	*Neches-Trinity*	*Trinity*	*Trinity-San Jacinto*	*San Jacinto*	*San Jacinto-Brazos*	*Brazos*	*Total Southeast*
2030									
In-Basin Demands	111.0	299.4	302.9	147.6	155.3	1155.6	554.0	526.8	3252.5
In-Basin Supplies									
Groundwater	23.4	114.6	8.7	41.2	27.9	266.3	87.8	169.4	739.3
Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	486.6	4195.8
TOTAL	1213.8	961.5	8.7	1397.6	27.9	524.0	145.6	656.0	4935.1
Surface Water Transfers									
Imported Supplies	1.0	4.1	294.2	0.0	127.4	691.6	408.4	0.0	1526.7
Export Demands	4.1	265.2	0.0	1023.7	0.0	60.0	0.0	173.7	1526.7
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**816.8**	**191.9**	**0.0**	**226.3**	**0.0**	**0.0**	**0.0**	**-44.5**	**1190.5**
2040									
In-Basin Demands	123.1	321.7	306.6	158.8	165.6	1258.2	604.5	580.7	3519.2
In-Basin Supplies									
Groundwater	23.5	116.3	8.8	43.8	29.6	280.5	88.8	181.1	772.4
Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	486.0	4195.2
TOTAL	1213.9	963.2	8.8	1400.2	29.6	538.2	146.6	667.1	4967.6
Surface Water Transfers									
Imported Supplies	1.0	4.6	297.8	0.0	136.0	698.0	457.9	0.0	1595.3
Export Demands	4.6	268.8	0.0	1072.6	0.0	60.0	0.0	189.3	1595.3
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**804.3**	**168.3**	**0.0**	**168.8**	**0.0**	**-82.0**	**0.0**	**-103.0**	**956.4**
2050									
In-Basin Demands	135.8	344.8	310.5	174.0	178.3	1343.2	653.2	636.2	3776.0
In-Basin Supplies									
Groundwater	23.6	118.3	9.0	46.7	31.0	291.8	89.7	197.3	807.4
Surface Water	1190.4	846.9	0.0	1356.4	0.0	257.7	57.8	485.4	4194.6
TOTAL	1214.0	965.2	9.0	1403.1	31.0	549.5	147.5	682.7	5002.0
Surface Water Transfers									
Imported Supplies	1.1	4.9	301.5	0.0	136.0	698.0	473.1	0.0	1614.6
Export Demands	4.9	272.6	0.0	1072.6	0.0	60.0	0.0	204.5	1614.5
In-Basin Reserves	282.9	209.1	0.0	0.0	0.0	0.0	0.0	0.0	492.0
Net Surface Water Availability	**791.5**	**143.7**	**0.0**	**156.5**	**-11.3**	**-155.7**	**-32.6**	**-158.0**	**734.0**

Appendix F

Trans-Texas Water Program Southeast Area
Report Comment Summary

Report	Author	Agency/Organization
Planning Information Update Report	Rusty Swafford, Branch Chief	U.S. Dept. of Commerce, NOAA
	Larry Wright, Acting Chief	U.S. Environmental Protection Agency, Region 6
	J. Tom Ray, Division Manager	Brazos River Authority, Planning and Environmental Division
	Will Roach, Acting Field Supervisor	U.S. Dept. of the Interior, Fish and Wildlife Service
	Dennis J. Crowley	TWDB
	Tommy Knowles, Deputy Executive Administrator for Planning	TWDB
	Tony Bagwell, Dir.	TWDB, Water Resources Planning Group
Phase II Interim Report	None received	
Upper Neches and Sabine Basin Report	Mike Personett, Director	TWDB, Local and Regional Assistance Division
	Gary Neighbors, General Manager	Angelina-Neches River Authority
	Tom Mallory	Upper Neches Municipal Water Authority
Equity Issues Related to Water Transfers	Tommy Knowles, Deputy Executive Administrator for Planning	TWDB
Galveston Bay Freshwater Inflows Assessment	Gordon Thorn, Director	TWDB, Research and Planning Funds Mngt. Division
	Cindy Loeffler, Team Leader	Texas Parks & Wildlife, Resource Protection Team
Impact of Potential Toledo Bend Operation Changes	Tommy Knowles, Deputy Executive Administrator for Planning	TWDB
	Gordon Thorn, Director	TWDB, Research and Planning Funds Mngt. Division
Water Conservation	Tommy Knowles, Deputy Executive Administrator for Planning	TWDB
Desalination	Tommy Knowles, Deputy Executive Administrator for Planning	TWDB

Wastewater Reclamation	None Received	
Systems Operations of Surface Water Supply Sources in the Houston Area	Tommy Knowles, Deputy Executive Administrator for Planning	TWDB
	Wayne Tschirhart	TNRCC, Water Supplies Section
Allens Creek Reservoir Environmental & Operations Studies	Edward A. Feith, Manager	Houston Lighting and Power, Environmental Dept.
	Frederick T. Werner, Chief	U.S. Dept. of the Interior, Regulatory Activities
	Don W. Hooper, Superintendent	Fort Bend Independent School District
	Jim McDonald, Mayor	City of Meadows
	Brandt Mannchen	Citizen
	Michael D. Rozell, Judge	Fort Bend County
	Allen Owen, Mayor	Missouri City
	Tom Condon, Jr., Vice President	The BETZ Companies
	Raymond R. Betz	The BETZ Companies
Environmental Analysis for the Neches Salt Water Barrier	Tommy Knowles, Deputy Executive Administrator for Planning	TWDB
	Richard Peterson, Superintendent	Big Thicket National Preserve
	Cindy Loeffler, Team Leader	Texas Parks and Wildlife, Water Resources
	Saul Aronow	Golden Triangle Sierra Club
Environmental Analysis for Potential Transfer Routes	Tommy Knowles, Deputy Executive Administrator for Planning	TWDB
Contractual Transfers	None Received	
General Comment	Patty Neild, Board Member	LNVA
	Mike Doguet	Doguet's Rice Milling Company
	Bill Dishman, Jr.	Citizen

Planning Information Update Report

Jeff Taylor

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Habitat Conservation Division
4700 Avenue U
Galveston, Texas 77551-5997

November 4, 1996

RECEIVED
NOV 5 1996
SABINE RIVER AUTHORITY
OF TEXAS

AG

Mr. Albert Gray
Sabine River Authority
Post Office Box 579
Orange, Texas 77630

Dear Mr. Gray:

We have reviewed the two reports titled *Planning Information Update* and *Phase II Program Update*, dated October 2, 1996, for the Southeast Technical Advisory Committee, Trans-Texas Water Program. We find the reports well prepared and very informative and have no comments at this time.

We appreciate this opportunity to offer our comments and if there are any questions, please call Mr. William Jackson of our office at: 409.766.3699.

Sincerely,

Rusty Swafford
Branch Chief
Galveston Field Branch

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

OCT 21 1996

Mr. Albert Gray AG
Sabine River Authority
P.O. Box 579
Orange, Texas 77630

Dear Mr. Gray:

Thank you for the opportunity to review the Trans-Texas Water Program reports: **Planning Information Update** and **Phase II Program Update.** The reports were transmitted to the Environmental Protection Agency (EPA) with your transmittal memo dated October 2, 1996.

Members of my staff in the Public Water Supply Supervision and Ground Water Protection programs have reviewed the reports and find them most informative and useful. We have no other comments on the contents of the reports.

We look forward to reviewing any future technical studies that the Trans-Texas Water Program committees are preparing. In particular, we would be interested in reviewing any studies conducted related to desalination and wastewater reclamation. These topics focus on a concern that may exist in several areas of EPA Region 6 (Texas, Oklahoma, Louisiana, New Mexico, and Arkansas) and we are always seeking additional technical studies for our information and use.

Once again, thank you for the opportunity to review these documents and should you have any questions about EPA's role in protecting the nation's water resources, please call me at (214) 665-7150.

Sincerely yours,

Larry Wright

Larry Wright
Acting Chief
Source Water Protection Branch

Brazos River Authority

QUALITY • CONSERVATION • SERVICE

June 4, 1996

Mr. Jeff Taylor
Brown & Root, Inc.
P.O. Box 3
Houston, Texas 77001-0003

Re: Comments on *Planning Information Update Report*

Dear Jeff:

I have reviewed the referenced report and have the following comments:

1. On Page 8, it is stated that "Projections indicate the Brazos basin has the greatest increases of population, reflecting substantial growth in Fort Bend County." This statement does not reconcile with the population projection details shown in Appendix B. The table labeled "San Jacinto Basin" indicates that Fort Bend County population growth is taking place in the San Jacinto basin and not in the Brazos River basin. Even with these corrections, the absolute increase in population for Fort Bend County does not compare to the absolute increase for Harris County. Comparatively, the statement referenced above would give more weight to the Fort Bend population than is justified. I would suggest discussing the population growth rate for Fort Bend County but include a comparison with Harris County's estimated 2050 population estimate.

2. On Page 28, in Section 5.3, an increase in existing groundwater supplies is noted. It is not clear that the 70,000 acre-feet per year is from increased supplies in the Brazos basin. If a substantial portion of this groundwater supply is from the Brazos basin, please specify the aquifer source.

Thank you for the opportunity to review the referenced report. If there are any questions, please do not hesitate to contact me.

Sincerely,

J. TOM RAY, P.E.
Planning and Environmental
Division Manager

JTR:rp
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4400 Cobbs Drive • P.O. Box 7555 • Waco, Texas 76714-7555
817-776-1441 • FAX 817-772-5780

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Ecological Services
17629 El Camino Real, Suite 211
Houston, Texas 77058

October 17, 1996

Albert Gray
Sabine River Authority
P. O. Box 579
Orange, Texas 77630

Dear Mr. Gray:

We have reviewed the draft Planning Information Update for the TTWP, Southeast Texas Area. Our concerns are for a water supply strategy that includes a consideration of adequate water for streamflow fishery management and adequate estuarine inflow to conserve the bay fisheries at levels considered appropriate by resource agencies.

On page 9, the update concludes that environmental water needs are considered non-consumptive. This would be the case for reservoir water and river water upstream of the lowermost reservoir but not for river water used to maintain proper salinities and nutrients for the estuary. This water is consumptive and should be included in calculations of demand along with other needs.

The memorandum also concludes that environmental water needs will be met prior to the identification of any remaining new supplies. If Toledo Bend is considered an existing supply, then one could conclude that environmental needs will not be considered at all. There are no other practical new water supplies in the future, excepting desalinization, as evidenced by the economics of past water investigations.

Wallisville Dam will allow complete utilization of Lake Livingston and run of the river water below this reservoir. Service support for this project is predicated upon a water supply strategy that includes providing maintenance water to the Trinity River from upstream supplies or interbasin transfers. This requirement needs to be included in the specific water allocation strategy recommended by this program.

The Service urges strong consideration of environmental water needs coincidental with other Southeast Texas water needs.

Thank you for the opportunity to comment on the Phase II report.

Sincerely Yours,

FOR Will Roach
Acting Field Supervisor

TEXAS WATER DEVELOPMENT BOARD

JWT

Bambi - Copies To
Jeff Taylor
Tom Gooch

August 10, 1995

AG

Mr. Albert Gray
Sabine River Authority
P. O. Box 579
Orange, Texas 77630

Jeff - Let's Discuss.
AG

albert

Dear Mr. Gray:

The Texas Water Development Board(Board) staff has reviewed the Enhanced Public Participation Study, the Planning Information Update Report, the Status of Environmental Issues for Allens Creek Reservoir and the Operations Studies and Opinions of Cost for Allens Creek Reservoir and offer the following comments:

1. **The groundwater availability numbers for the Houston metropolitan area are likely significantly overstated and were developed from a different source and utilized on an inconsistent basis with the Board demand forecasts used elsewhere in the Southeast study area analysis. These groundwater availabilities were developed on the basis of the high demand forecasts from the Harris-Galveston Coastal Subsidence District's(District) 1989 report. Applying the new and lower Consensus Water Plan demand forecasts to each zone's conversion policy will likely have a noticeable effect in reducing groundwater availability. It is our understanding that even the District's new demand forecasts, still in draft form, are noticeably lower than their previous study's forecast used as the basis for groundwater availability in the draft Phase II Southeast study area report.**

2. **It is also the opinion of the District that the 90%/10% SW/GW policies in Zones 1 and 2 have had and will have the effect of placing most past and nearly all future demand upon surface water for these zones.**

3. It is the opinion of the Board planning staff, likely concurred with by the Brazos River Authority(BRA) staff, that there are significant additional basin surface water supplies available in the lower zone of the Brazos basin with the provision of water from their presently developed system-operated reservoirs.

4. It is the opinion of the Board planning staff that there is on the order of 100,000 ac-ft/yr of additional supplies potentially available from the Trinity River, even considering a set-aside for in-basin needs and other presently active or likely-active senior rights in the lower basin.

5. The coastal basins have some local surface water supplies (approx. 50,000 ac-ft/yr) that are currently available and permitted and were not utilized in the analysis.

If you have any questions regarding these comments, please contact Tony Bagwell at (512) 936-0813.

Sincerely,

Dennis J. Crowley, P.E.

Brown & Root, Inc.

Post Office Box 3
Houston, TX 77001-0003

April 19, 1996

Mr. Dennis Crowley
Texas Water Development Board
P.O. Box 13231
Austin, TX 78711-3231

Dear Mr. Crowley,

We received your comments on the *Planning Information Update Report,* dated August 10, 1995. Each issue was thoroughly researched and additional information was obtained through discussions with staff members from the TWDB, City of Houston and the Trinity, Brazos, and Sabine River Authorities. The responses to your comments follow:

Items 1 and 2: Groundwater Projections in the Southeast area.

The Texas Water Development Board (Board) commented that lower groundwater withdrawals within Harris and Galveston counties should be used in Phase II. For the Southeast study, we accept the current groundwater projections of the Harris Galveston Coastal Subsidence District (HGCSD) plan as the available groundwater yield in Harris and Galveston counties. We believe this assumption is valid as long as total countywide water use exceeds the HGCSD projections because suppliers will maximize groundwater use before surface water sources as the cheaper cost source of supply.

We have, however, adjusted the Phase I groundwater projections. Phase I TTWP projections extended the HGCSD year 2030 values through the 2050 TTWP time frame. This provided increased levels of groundwater use after 2030. We have reduced the 2040 and 2050 groundwater availability values to remain constant at 2030 levels since no information exists to support any other assumption. This adjustment has resulted in lower groundwater availability in the Neches-Trinity, San Jacinto and San Jacinto-Brazos basins after year 2030.

Item 3: Surface water supplies in the lower zone of the Brazos basin.

Both the Board and our project study indicate shortages in the Brazos basin within the study time period though the Board's shortages are not as large as those projected in the Southeast study. Discussions with Board staff indicate that the primary difference results from assumptions on the development of future supply projects within the Brazos basin. The Phase I TTWP report does not include any future supply projects. It represents the comparison between *existing* supply and future demand. The Phase I report does not include projects such as the Lake Whitney re-allocation project that would redefine federal hydropower yield as consumptive use (~100,000 acre-feet/year). Discussions with the Brazos River Authority (BRA) revealed that redefining the Lake Whitney yield requires an act of Congress and BRA has no plans to initiate this effort in the foreseeable future. We believe our current value is consistent with the methodology used throughout the TTWP program and is an accurate statement of current supply.

Item 4: Additional supply available from the Trinity River.

The Board recommends the addition of about 100,000 acre-feet/year to the Lake Livingston yield in the belief that more yield will exist if an amendment to the lake permit removes the subordination of Livingston to upstream undeveloped reservoirs. After extensive review of the Lake Livingston permit, we have determined that the actual Lake Livingston permitted yield is 1,255,500 acre-feet per year instead of the value of 1,065,000 acre-feet per year used in the Phase I report. The full permitted yield will be used in future TTWP efforts. However, the Trinity run-of-river yield consists of the fixed rights agreements. These rights are only valid because of reservoir yield within Lake Livingston (i.e. these flows come from storage). The Phase I report of 180,000 acre-feet/year for run-of-river flow has been eliminated from the Trinity supply total.

Item 5: Surface water supply in coastal basins.

The Board commented that local surface water supplies in coastal basins are excluded from the supply totals. We have been unable to document firm dependable surface water supplies within either the Neches-Trinity or the Trinity-San Jacinto coastal basins. The Phase II report therefore will continue to use a zero quantity of surface water supply within those basins.

The Phase I report noted but did not use senior water rights for four entities within the San Jacinto-Brazos coastal basin. At that time, we could not reconcile the TWDB estimate of 211,000 acre-feet per year for run-of-river yield with the of 454,644 acre-feet per year of these four entities. Based on the TWDB comments, we believe that a total of 40,000 and 17,784 acre-feet per year can be included as firm supply for the Chocolate Bayou Water Company and Richmond Irrigation/Houston Lighting & Power Company, respectively. For Phase II purposes, this modification will produce a San Jacinto-Brazos coastal basin surface water supply of 57,784 acre-feet per year. We believe however, that the true determination of reliable surface water supplies in the lower Brazos and San Jacinto-Brazos coastal basin is not adequately defined, and would recommend a complete detailed study of this issue.

Thank you for your careful review of the report and your comments. If you have further comments or questions, please contact the me at (713) 676-7866.

Sincerely,

Jeff Taylor
Project Manager

cc: Albert Gray
Tom Gooch

2-9-96

Southeast Area Water Supplies

The TWDB water supply comments to the Planning Information update report were discussed with TWDB members TRA, BRA, SRA, City of Houston, Tom Gooch, David Parkhill, and Jeff Taylor during the course of the Fort Worth TWCA meeting. The following is a synopsis of the discussions.

1) Lake Livingston Yield- The TWDB is recommending the addition of about 100,000 ac-ft/yr to Livingston due to a belief that more yield will exist if the Lake Livingston permit is amended to remove the subordination of Livingston to upstream unbuilt reservoirs. While subordination language is included within the Livingston permit, the original yield calculations do not appear to reflect the existence of upstream reservoirs. Additionally, The TRA feels legally bound to continue the current Livingston permit. There is some doubt that upstream return flows (which represent ~300,000 ac-ft) would be found to be as high as originally projected, if a new analysis was conducted, thereby potentially reducing the current Livingston yield if a re-analysis was performed. The result is that the existing Lake Livingston yield is what will be used within our Planning Information Update report, and no future water management option will be created to attempt to obtain more yield.

2) HGCSD groundwater projections. The TWDB commented that lower groundwater withdrawals within Harris and Galveston counties should be used due to a belief that safe yield is exceeded above a certain amount of withdrawal. The TWDB is now using a higher value of groundwater use than originally used in their Texas Water Planning process. Their number relates the conversion date percentage allocations of surface and groundwater to the projected water demand within those counties. This is different than our methodology where we simply use the groundwater projections shown in the HGCSD plan. This assumption is valid as long as total water use exceeds the HGCSD groundwater projections. Users will maximize groundwater use first because it is cheaper than surface water. The HGCSD projections end at year 2030. We increased these values to obtain numbers for years 2040 and 2050. We will now amend our previous numbers for years 2040 and 2050 and set them equivalent to the year 2030 value simply because we have no data to support any other assumption.

3) Brazos River Shortfalls- The TWDB commented that our projected shortfalls within the Brazos basin are too

high. While the TWDB shows future shortfalls in the Brazos, they are not as large as ours (about 130,000 ac-ft/yr lower). We have concluded with Steve Densmore that the difference lies with assumptions regarding the development of future supply projects within the Brazos basin. Our numbers do not include any future supply projects, they only represent a comparision between existing supplies and future demands. The TWDB included a Lake Whitney re-allocation project to redefine federal hydropower yield as consumptive uses (~100,000 ac-ft/yr). Our value for the existing condition is correct. Discussions with the BRA revealed that an act of congress is needed to redefine the Lake Whitney yield. The BRA is not planning on initiating this effort within any forseeable timeframe due to the extensive level of involvement. We will therefore not include this project as a future supply option either.

Jeff

cc. David Parkhill
Tom Gooch
Ann Wood

TEXAS WATER DEVELOPMENT BOARD

June 11, 1996

Mr. Albert Gray
Sabine River Authority
P. O. Box 579
Orange, Texas 77630

Dear Mr. Gray:

Please find attached for your consideration Texas Water Development Board staff comments on the Planning Information Update draft memorandum for the Southeast area. If you have any questions or comments, please call Dennis Crowley, P.E. at (512) 463-7976, Mike Personett at (512) 463-8061 or Butch Bloodworth at (512) 936-0880.

Thank you for your cooperation.

Sincerely,

Tommy R. Knowles
Deputy Executive Administrator
for Planning

cc: Jeff Taylor

P.O. Box 13231 • 1700 N. Congress Avenue • Austin, Texas 78711-3231
Telephone (512) 463-7847 • Telefax (512) 475-2053 • 1-800- RELAY TX (for the hearing impaired)
URL Address: http://www.twdb.state.tx.us • E-Mail Address: info@twdb.state.tx.us

Attachment

COMMENTS ON PLANNING INFORMATION UPDATE DRAFT MEMORANDUM TRANS-TEXAS WATER PROGRAM SOUTHEAST AREA

The Board's updated water demand projections, which were completed in 1995, indicate a lessening of projected statewide water demands relative to the Board's 1991 forecast. Regarding the impacts of the new forecast on the future water supply needs of the Houston area, several points of clarification need to be offered. First, recent statements that a 700,000 to 800,000 acre-foot decrease in projected water demands for the region is the primary reason for the projected delay in the need for additional water supplies is misleading. This level of decrease in projected water demands is for the Trans-Texas Southeast Study Area as a whole and includes projected decreases in water demand for agriculture and other sectors. It also includes other areas of the entire 32-county study area that are not part of Houston's current or future water service area and therefore do not directly affect the timing of the need for additional water supplies for the Houston area.

With respect to municipal water use projections, the largest impact was not conservation but the reduced period of record for developing per capita water use projections. The period of record for developing per capita water use projections for the 1991 forecasts was from 1970 through 1990 while the period of record for the 1994 forecasts was from 1982 to 1991. For many cities, per capita water use projections developed from the shorter period of record are less than the per capita water use projections developed for the 1991 forecasts. Consequently, the lower per capita water use projections result in less water use over time even though the population projections for the 1994 forecasts are higher for the larger municipal water use areas (San Jacinto basin, Trinity-San Jacinto basin, and the San Jacinto-Brazos basin).

The report continuously references total water demands when they should be placing emphasis on the water use categories that will drive future interbasin transfers, specifically, municipal and industrial water use. These two important water use categories become masked in the total water demand numbers when they should be the major reference of water needs in each basin. Additionally, the report continuously references the entire Southeast study area total water demands. It is Board staffs impression that the reason for this study was to develop analyses for the future water needs and water supplies primarily for the Houston area and to develop alternative solutions for supplying these future needs. The only apparent reason for looking at the Sabine, Neches, and Neches-Trinity basins would be to see if excess supplies of water exist over time for possible transfers to areas in the San Jacinto, Trinity-San Jacinto, and the San Jacinto-Brazos basins should water supply deficits occur in the future.

The difference between the Board's 1991 and 1995 projections for Harris County is a decrease of 319,237 acre-feet per year in the year 2040. Of that decrease, 273,890 acre-feet is in manufacturing and 45,506 acre-feet per year is in projected municipal water demands by 2040.

It should be noted and emphasized that the significant reduction in projected manufacturing water demand for Harris County was almost entirely due to lower rates of regional industrial growth forecasted by the federal Bureau of Economic Analysis (BEA) between their mid-1980's

forecasts and their more recent econometric forecasts. The Board uses these national/regional econometric forecasts as the basis for our manufacturing water use projections.

Board staff were concerned about the very high rates of manufacturing growth contained in the earlier BEA forecast and were apprehensive that BEA was placing too much emphasis on the rapid growth of the early 1980s and did not fully appreciate that industrial growth occurs in cycles and not at sustained high rates over the long-term. When the BEA released a new forecast in the early 1990's, considerably more realistic rates of manufacturing growth were forecasted for the Houston area. By using the new national/regional econometric forecasts, the Board's manufacturing water use projection for Harris County did decline significantly relative to the Board's 1991 forecast. We believe that our 1995 projections for manufacturing water use in Harris County are much more realistic than our 1991 forecast. However, it should be noted that the scenario used for manufacturing in the Board's 1995 projections was the baseline BEA forecast which assumes a continuation of current oil price levels. The BEA's upper level forecast (low oil prices) would have resulted in a higher forecast for manufacturing growth and a smaller reduction in projected industrial water use for Harris County (111,233 acre-feet rather than 273,890 acre-feet per year).

It should also be noted that very little of the reduction in projected manufacturing water demand can be attributed to water conservation assumptions. Both in the Pequod study and in the Board's forecasts, it was made very clear that the introduction of major water efficiency improvements in industry is tied to the timing of new plant construction and plant renovation and that industry would not be likely to implement major water efficiency improvements until such investments are economically feasible. In fact, Board staff even slowed the rate of industrial water efficiency practices and savings that were forecasted by Pequod because we thought it was occurring too rapidly given the manner in which industry makes these type of improvements. The 1995 forecast does include, however, water use efficiency improvements for high-tech industries, such as semiconductors, which were not included in the 1991 forecast. The 1995 forecast include water efficiency reductions of 40 percent for these particular types of industries.

Regarding the Board's population projections for Harris County, the 1995 forecast shows 174,393 more people in Harris County by the year 2040 than the 1991 forecast showed while the municipal water use projections are 45,506 acre-feet lower than the 1991 forecast. There are two reasons for this. First, the historical period-of-record for per capita water use that was used to develop the 1991 forecast was from the late 1970s to 1990, while the historical record of per capita water use used for the 1995 forecast was a shorter period from 1982 to 1991. The period-of-record was reduced at the request of TNRCC staff who maintained that only more recent water use rates should be reflected in the new forecast. This shorter period-of-record resulted in a reduction of 10 gallons per capita per day for Harris County relative to the per capita water use rate used by the Board in the 1991 forecast (i.e. 194 gpcd for the 1991 forecast and 184 gpcd for the 1995 forecast). Second, the municipal water conservation savings used for the 1995 forecast for Harris County resulted in an additional four (4.0) gallon reduction in daily per capita use by the year 2040 relative to the 1991 forecast.

Board staff would also like to briefly comment on the change in the thrust of the consultants findings between the Trans-Texas Southeast Area Phase I and Phase II planning reports. From our perspective, the only planning data that has changed that significantly affects Houston's

projected need for additional water supplies is the 1995 consensus water demand forecast. Again, this resulted in a reduction of approximately 320,000 acre-feet per year in water demand for Harris County by 2040. However, we would also like to note that Board staff did not agree with all of the values for water supply availability that were used in the Phase I report. In particular, we believed that significant quantities of existing water supply are available in the Houston area and that these supplies were not reflected in the Phase I findings. The subsequent incorporation of these additional supplies in the Phase II planning report, combined with the decrease in projected water demands, further shifts the timing of Houston's need for additional water supplies.

Another significant difference between the Board's long-term water planning assumptions and those used in the Phase I and II reports is the amount of ground-water shown to be available for Harris and Galveston counties. The Trans-Texas Southeast Area Phase I and II planning reports reflect the Subsidence District's current policy of requiring a percentage of existing ground-water use to convert to surface water use and then allowing a proportionate amount of new growth to be supplied from additional ground-water development.

Board staff have completed in-house, up-dated forecasts of groundwater availability in the Houston area and are currently waiting on supplemental information from the Subsidence District's engineer in order to further analyze this issue. Pending receipt and analysis of the requested data, Board staff recommends that our new planning projections for groundwater demand be used which will be forwarded to you shortly. This new data will likely lessen groundwater availability from the earlier numbers used in the Southeast Planning Update report and should advance the timing of need for various other management options.

MEMORANDUM

TO: Trans-Texas Consultant Team DATE: June 18, 1996

FROM: Jeff Taylor

SUBJECT: TWDB Planning Report Comments

Attached are some of the TWDB comments on the Planning Information Update Report. While many of these comments can be addressed by modification of the report language, several comments require a shift from our current TTWP philosophy. The following are my comments. Please review the attached and let's discuss prior to completing the final Planning Information report.

The TWDB suggests a stronger emphasis on the future needs of the Houston region, as opposed to discussing the entire Southeast study area.
This can be done by creating a supply/demand comparison for the Houston SMSA and by adding additional comments on future localized impacts. However, this will probably not modify the basic conclusion that interbasin transfers of east Texas water are not needed in a shorter timeframe. Our allocation of supply to the demands, effectively treated the Houston SMSA separately from east Texas (i.e. the current analysis accurately illustrates the Houston needs.)

The TWDB suggests that a more detailed look at the municipal and industrial categories instead of the total demand may drive the need for interbasin transfers.
Focusing on these categories will require a more detailed look at the distribution of water rights within each demand category. The current analysis, however, only uses firm yield supplies. To expedite interbasin transfers, would require that we allocate firm yield supply to less than senior water rights. I do not believe that this is possible based on the current definition of supplies and demands in the study.

The TWDB appears to suggest that the emphasis of the TTWP return to "interbasin transfer of east Texas water" as the foundation of the program.
This was not my impression of the intent of the PMC based on their actions following the political fallout with the east Texas politicians. Should we decide to change the current course, the scope can be modified to more expeditiously arrive at an interbasin transfer option.

Jeff Taylor
Project Manager

cc:

N:\DATA\ENGINEER\JR1492\PLANNING\TWDBRPT

July 11, 1996

Mr. Jeff Taylor
Environmental/Water Resources
Brown & Root, Inc.
P.O. Box 3
Houston, Texas 77001-0003

Re: Ground-water Availabilities for Harris and Galveston Counties

Dear Jeff:

I am following our previous phone conversations with a written communication outlining my staff's recommended advice to the S.E. area Trans-Texas study concerning ground-water availability in the Houston area.

As we had discussed, the Board has completed the in-house, preliminary analysis of the Board's updated Houston-area water demands and the application of the Harris-Galveston Coastal Subsidence District's (HGCSD) pumpage-limitation policy to those total water demands to produce estimates of projected ground-water availability and pumpage for the area. Steve Densmore of my staff recently communicated those values to you for your near-term use, given the relatively tight time frame in releasing the revision of your Planning Update report.

As we had also discussed, the Board is in the process of obtaining additional information from the HGCSD concerning their own updated planning forecasts on ground-water availability. Some preliminary computer file information provided to us (if we are interpreting it correctly) indicates that there may be differences in the total water demand forecasts for the two counties between the District's new numbers and ours, with the District's new demand numbers seeming to be much lower than ours (rather interesting given that everyone has been saying the Board's new numbers were too low). For instance if we are interpreting their files correctly, their year 2000 total water demands seem to be less than the reported historical M&I use to us for 1993. We have requested further data from the District to better ascertain if there are indeed differences and why.

So, where does this leave your effort? At this point, there seems to be two choices: (1) wait until these differences are clarified and resolved with the District which could take two weeks or so, or (2) proceed with our new ground-water availability numbers provided to you by Steve Densmore, and make any needed changes later.

Since you have a need to proceed expeditiously, I would recommend Option #2 as we feel the Board's new numbers will bring your updated planning report much closer to what the ground-water availability is likely to be for the Houston area. Certainly the Board's new preliminary forecasts will be much closer to a final answer than the availabilites used in the previous SE-TT report from the District's 1989 Master Plan.

Should you have any questions, please call.

Sincerely,

Tony Bagwell

Tony Bagwell
Director, Water Resources Planning Division

cc: Albert Gray (SRA)
David Parkhill (B&R)
Dennis Crowley (TWDB)

Upper Neches and Sabine Basin Report

September 3, 1996

Mr. Jack Tatum, P.E.
Sabine River Authority
P. O. Box 579
Orange, Texas 77630

Re: Texas Water Development Board (Board staff) Comments on the Projected Water Needs and Supply of the Upper Neches and Sabine River Basins, July,1996

Dear Mr. Tatum:

Board staff has reviewed the above-referenced report and offer the following comments:

A. PROJECTED WATER NEEDS AND SUPPLY

1. Approximately 44,000 ac.ft. of the projected future water needs in the Upper Sabine basin is due to steam power generation. These projected needs are due to growth in the basin or known expansions at power plants. While known expansion could be met with present supplies, the additional needs due to growth could be anywhere in-basin or out-of-basin under the present electrical grid system. This could also be true of power needs in other basins, i.e., power needs that Board staff has projected for one basin could in reality be located in another basin.In order to reduce confusion, Board staff has assigned future power needs to existing projects. Board staff recommends that these uncertainties with regard to the location of future power generation water demands be pointed out in the report.

2. Board staff does not recommend limiting ground water to the 1990 pumping levels. There appears to be adequate ground water resources to meet the needs of most cities that are currently using ground water. In fact, some of the cities that have options or contracts for surface water may not require or use surface water. This unused surface water might be available to meet other basin demands.

3. The estimate of supply for Texas Eastman (TE) appears to be low. TE has permits for 135,000 ac.ft. and an analysis by Board staff indicates that TE's demand to be about 80,000 ac.ft. Board staff recommends that the consultant review the TE demands and if there is information available to support the projections in the report that copies of the information be provided to the Board.

4. Information available to Board staff indicates that contracted supplies from Lake O' the Pines to Brandy Branch is 18,000 ac.ft. rather than 15,100 ac.ft.

5. Generally, livestock demands are met from local supplies or ground water resources. Board staff recommends that livestock demands not be included in Table 10.

6. Presently most of the mining water needs are met from local supplies or ground water from mining operations. In the 1990 Water Plan, it was anticipated that this practice would continue and that future mining demands would be met with ground water at or near the mines.

7. Board staff recommends that Martin Lake be reserved for meeting only steam power needs since permit and water quality limits would prohibit uses for other water demands.

8. A general comment is that if the assumptions presented in the report are followed then 115,000-150,000 ac.ft. of water should be reserved. However, if the recommendations and assumptions offered here are used then the maximum amount of water needed for reserve may not exceed 100,000 ac.ft.

B. POPULATION PROJECTIONS, CONSERVATION, AND PER CAPITA WATER

1. The report indicates that the population projections in both basins are characterized by low estimates of population growth. This is true for most of the counties in both basins because the basic demographic characteristics of these counties tend to lead to relatively slow growth. These counties have populations that are substantially older that the state as a whole and are mostly rural in nature. The most significant characteristic with respect to future growth for these counties is the age of the population. The median age of the state's population is 30.8 years as compared to 39.6 for Wood County, 38.9 for Henderson County, 38.2 for Rains County, 33.2 for Smith County, and 35.0 for Cherokee and Rusk Counties. Collin and Anderson Counties have the youngest population with a median age of 30.9 and 31.4, respectively. With respect to the 1990 Census age structure for those counties in the Upper Neches basin, the percentage of county residents of 30 years of age and older range from a high of 66 percent for Cherokee County to a low of 56 percent for Smith County. For the Upper Sabine basin, the percentage of county residents 30 years of age and older range from high of 62 percent for

Wood County to a low of 53 percent for Collin County. As a comparison, 52 percent of the state's population is 30 years of age or older. Additionally, most of the counties are not in close proximity to large metropolitan areas, with the exception of Collin, Rockwall, and Kaufman Counties, which often tends to reduce the influence of migration into predominately rural counties.

It is true that some of the counties' population projections begin to decline after a certain future decade. The reason for this occurrence is that the population is becoming older, and with modest numbers of migrating into these counties, the natural increase in population begins to decline over time. These consensus population projections are based on 1990 Census information provided to the Board, TNRCC, and TWPD staffs by the State Data Center and include projected fertility rates, survival rates, and recent migration rates for each of the counties in the study areas.

Historically, many of these counties experienced slow to modest population growth between 1950 and 1990. For example, the population of Cherokee County has only increased by 2,355 people over this forty year period. Population increases over this same forty year period for other counties include an increase of 2,785 people in Panola County, 1,384 people in Rusk County, 1,545 people in Franklin County, 5,343 people in Hopkins County and relative modest increases for other predominately rural counties in the study area.

2. The major component of water savings associated with the expected municipal conservation case is the continued implementation of state and federal laws requiring installation of more water use efficient plumbing fixtures in new residential and commercial structures as well as replacements of these types of fixtures in current structures. For example, the portion of the potential municipal water savings attributed to plumbing fixture improvements for the Upper Neches basin in the year 2050 accounts for about 65 percent of the projected decrease in per capita water use. These are water savings that are anticipated to occur with future residential and commercial construction and replacement of old fixtures due to age and failure. With just the replacement of the old five-gallon toilet with a new 1.6 gallon toilet, a savings of 3.4 gallons per flush or about 68 percent can be realized. Board staff believes that these water savings are going to occur with a relatively high degree of predictability and are not dependent upon active water utility or consumer support.

3. In response to the statement regarding what the impact would have been if the Texas Department of Water Engineers had decided in 1935 that further growth in per capita water use was unlikely, per capita water use did in fact increase with the significant growth in the state's population as well as the introduction of modern household fixtures. However, over the last 15 years or so, the trend of increasing per capita water use has been reversed. With the exception of years of very dry climatic conditions, average statewide per capita water use has trended

downward (See 1990 State Water Plan). This downward trend can be explained by improvements in water efficiency of plumbing products and water-using appliances, demographic and housing changes, and the effects of increasing real costs for water and wastewater services.

4. The report is correct in its assumption of occurrences that could happen over the next 60 years that are not included in the consensus projections. Limitations of these projections are identified in Volume III- Water Use Planning Data prepared by the TWDB, TNRCC, and TWDB staffs. Projections are based on the best information available at the time along with the assumptions and scenarios that are developed for making the projections.

Board staff hopes that these comments are of benefit to you and should you have any questions please call Dennis Crowley at (512) 463-7976.

Sincerely,

Mike Personett

Mike Personett, Director
Local and Regional Assistance Division

cc: Members, Trans-Texas Southeast Area Policy Management Committee
Jeff Taylor, Brown and Root
Tom Gooch, Freese and Nichols

RESPONSE TO COMMENTS

Response to Comments from TWDB:

A. Projected water needs and supply:
1. Text added in Section 8, Factors of Uncertainty.
2. Considered, but not implemented. A division of demand between groundwater and surface water on an entity by entity basis was not in the scope of this project. Additionally, some entities currently using groundwater wish to convert to surface water.
3. Supply available to Texas Eastman was based on detailed analysis of their system.
4. Incorporated in report as suggested by TWDB.
5. Text added in Section 8, Factors of Uncertainty.
6. Text added in Section 8, Factors of Uncertainty.
7. Incorporated into report, Table 10.
8. Noted.

B. Population projections, conservation, and per capita water:
1. Noted.
2. Noted.
3. Noted.
4. Noted.

UPPER NECHES RIVER MUNICIPAL WATER AUTHORITY

AN AGENCY
OF THE
STATE OF TEXAS

December 28, 1995

Thomas C. Gooch, P.E. Principal
Freese and Nichols, Inc.
4055 International Plaza, Suite 200
Ft. Worth, Texas 76109-4895

Subject: Draft Memo - Projected Water Heads and Supply of the
Upper Neches and Sabine River Basins

Dear Tom:

Thank you for the opportunity to review and comment on the subject draft report. I generally agree with your methodology and conclusions. I also agree with your reservations and limitations which must be recognized in making long term projections, both in population and other water parameters.

Actually the data is very telling, in that it appears fairly obvious that some river basin segments operated as a system would result in more efficient utilization of water resources. It could also result in significant cost savings to the end users.

The per capita water use projections may be too dramatic, however, as you note in the report, the trend certainly does reflect significant reductions. There are many unknowns that make this very important element of water planning difficult.

Other factors which will obviously have impact on the availability of water are the effects on recreation of full reservoir yield utilization, parochialism and sheer politics.

MAILING ADDRESS
P. O. DRAWER 1965
PALESTINE, TEXAS 75802

PHONE: 903-876-2237

ADMINISTRATION BUILDING
ON LAKE PALESTINE AT
BLACKBURN CROSSING DAM

Finally, ground water will continue to be a factor in the Upper Neches Basin. While we have had a water table decline, we are a long way from not having quality ground water available for all uses.

Thank you again for the opportunity of review and comment. Having had the opportunity to manage significant water resources in the Upper Neches Basin, I have gained some insight into this matter which I am pleased to share.

Sincerely,

T. G. Mallory
General Manger

Response to Comments from Upper Neches Municipal Water Authority:

No response or revisions necessary.

Response to Comments from Angelina & Neches River Authority:

1. Changed the report to show Lake Eastex's yield as 85,507 acre-feet per year.
2. Any part of the available water supply sources known to be committed to supplying entities outside of the Upper Basin was listed as export in the comparison of needs and supply. The fact that water may be committed to long-term needs in-basin makes it necessary that supplies exceed demands to supply other entities.
3. It was beyond the scope of this project to compare supply sources and demands on a local scale within the Upper Basins.
4. Lake Eastex was sited as a source for meeting the needs of the Upper Neches Basin.
5. The Trans-Texas scope specifies that the TWDB population and water use projections will be used for this project.
6. Lake Eastex was sited as a source for meeting the needs of the Upper Neches Basin.

Add to end of Section 8:

Other factors of uncertainty in the projections presented in this report are the livestock and mining water demands. In the past, much of this demand has been met by local supplies such as stock tanks and private wells. These local supplies are not included among the available resources listed in this report. The TWDB anticipates that livestock and mining demands will continue to be met with groundwater or local surface supplies.

Another factor of uncertainty in the projections in this report deals with the location of future power generation water demands. Approximately 44,000 acre-feet of the projected future water need in the Upper Sabine basin is due to steam power generation. These projected needs are due to growth in the basin or known expansions at power plants. While known expansion will probably be met with present supplies, the additional needs due to growth could be anywhere in-basin or out-of-basin. This could also be true of power needs in other basins. In other words, future power needs in the Upper Sabine could be greater or less than projected by TWDB, depending on the location of future projects.

Equity Issues Related to Water Transfers

March 6, 1998

Mr. Jeff Taylor
Brown & Root, Inc.
P.O. Box 3
Houston, Texas 77001-0003

Re: Texas Water Development Board (Board staff) Comments on Trans-Texas Water Program "Equity Issues Related to Water Transfers", January 16, 1998

Dear Mr. Taylor:

Board staff has reviewed the above-referenced report and offer the following comments shown in Attachment 1.

The Board looks forward to receiving one (1) unbound camera-ready original and nine (9) bound double-sided copies of the Final Report on this planning project. Please contact Mr. Gordon Thorn, Director, Research and Planning Funds Management Division, at (512) 463-7979, if you have any questions about the Board's comments.

Sincerely,

Tommy Knowles
Deputy Executive Administrator
for Planning

P.O. Box 13231 • 1700 N. Congress Avenue • Austin, Texas 78711-3231
Telephone (512) 463-7847 • Telefax (512) 475-2053 • 1-800- RELAY TX (for the hearing impaired)
URL Address: http://www.twdb.state.tx.us • E-Mail Address: info@twdb.state.tx.us

ATTACHMENT 1

TEXAS WATER DEVELOPMENT BOARD

COMMENTS ON TRANS-TEXAS WATER PROGRAM
"EQUITY ISSUES RELATED TO WATER TRANSFERS"

1) Page 5, as noted in **2.1 Legislation**, third paragraph, addressing issues across jurisdictional boundaries is important for resolving conflicts. However, the report does not explain how a "watershed approach to water management" will adequately address issues that transcend major watershed boundaries.

2) Page 29, next to last paragraph, the report notes that "There is also a need for information about economic development in the basin of origin and the receiving basin(s)." Any information gathering effort should examine the linkages between water and economic development, and consider the following:

   a) What are the types of economic development that a basin of origin and the receiving basin are seeking to attract? Not all industries are large water users. Five manufacturing industries account for approximately 90 percent of the 1.56 million acre-feet of water currently used by all manufacturing industries in Texas. These five water-intensive industries are chemical products, petroleum refining, pulp and paper, food and kindred products, and primary metals. (Source: *Water for Texas–Today and Tomorrow, A 1996 Consensus-Based Update to the Texas Water Plan. Volume III, Water Use Planning Data Appendix*) Factors such as labor force characteristics, cost of living, tax structure, etc. may be the key considerations in many types of industrial site location decisions.

   b) What is the impact of water quality on economic development? This could address the importance of good quality water as an input for some types of industrial processes, and as a consideration in personal decisions to relocate to an area. As the report noted, the South East Texas Regional Equity Task Force proposed wastewater infrastructure improvements as one type of compensation for a water transfer. This, in effect, would trade some water supply for improvements in water quality.

3) Page viii and page 29, the report does not clearly establish a need for creating a new planning entity "to undertake the information gathering programs needed for decision-making on water transfers from the Sabine Basin." What are the advantages of creating a new entity? Could this role be assigned to an existing planning agency or a university?

4) The report identifies a list of likely third parties, suggests compensation to third parties, develops some case studies, and makes a case for gathering additional information. It does not fully describe the issues associated with compensating all of those who might be affected by a proposed transfer. Specifically, what kind of organization(s) within a basin of origin would be able to take broad action that would "compensate" all or most those most likely to be affected by a transfer? How can an area choose among alternate types of compensation? How does an

interest demonstrate justification for receiving compensation? It would seem beneficial to at least raise some of these types of issues.

5) The report adequately describes the sometime difficult issues confronting interested parties and the difficulty in reaching consensus when potential water transfers are being discussed. With respect to the potential water transfer in the Southeast Texas area, the recommendations presented in the report are realistic and reasonable. Additionally, the authors recognize one of the most important aspects of these types of issues and that is data sharing and involving the parties in the actual analyses (economic development, future water needs assessment, water supplies availability analyses, and third party benefit/cost analysis). The report is a good start to addressing future conflicts and issues relating to water transfers not only in the Southeast Texas area but also in other areas of the state.

April 13, 1998

Mr. Gordon Thorn
Director, Research and Planning Funds Management Division
Texas Water Development Board
P. O. Box 13231
Austin, Texas 78711-3231

In Re: Trans-Texas Water Program "Equity Issues Related to Water Transfers", January 16, 1998

Dear Mr. Thorn:

The project team has reviewed comments on the captioned draft report submitted by the Texas Water Development Board. Your comments raised several very good questions that will need to be addressed as water planning progresses to meet Texas' future needs.

Responses to specific comments are:

1. Page 5, under 2.1 Legislation: The report says that "the need for a watershed approach to water management (crossing jurisdictional boundaries)" is one of the factors favoring state or federal legislation as a way to resolve interjurisdictional conflicts. It is legislation rather than the watershed approach that can address issues that transcend watersheds.

2. Page 29: Your suggestions for future research on the linkages between water and economic development are excellent.

3. Page 29: Re an entity to undertake information gathering, the key point is the inclusion of many interests which are not now part of an existing group. As noted on page 30, a regional water planning group formed under SB-1 might serve this function.

4. Your comment raises a number of interesting questions about compensation of third parties that should be pursued in future research.

5. Thank you.

We agree that this report is a good beginning for looking at interbasin transfer issues in the state of Texas. We look forward to working with TWDB to address the remaining questions.

Sincerely,

Jeff Taylor
Project Manager

Galveston Bay Freshwater Inflows Assessment

Comments on Galveston Bay Freshwater Inflows Study, prepared by Brown & Root, Inc., and Freese and Nichols, Inc.

Comments by

Environmental Section, TWDB

The comments below refer to specific statements in the report and are referenced by page, column, and paragraph or line of the report.

Page 1, column 1, paragraph 1. The introduction states that GBFIG conducted some initial analysis of the freshwater inflows into Galveston Bay and that this technical memorandum summarizes the result of those studies. We understand that GBFIG did not conduct inflow studies. Instead, TWDB's Research and Planning Funds for the TTWP were used to contract studies with Brown and Root, Inc. (BRI) and Freese and Nichols, Inc. (FNI), who also authored the draft report. The study was requested by GBFIB at the PMC meeting of the TTWP, Southeast Area, on September 18, 1997. We also understand that Tx A&M University may have developed the water rights model for estimating naturalized, current, and future flows based on water rights usage. The entire report is somewhat unclear on the issue of who did the modeling, the analyses, and the recommendations. We recommend this issue be clarified by appropriate citations and credits for the models, etc.. Currently it is difficult to tell who did what in this report.

Page 1, column 2, line 26, "Current conditions are simulated by . . .": The brief definition of the "current condition" described here leads the reader to think that the "current condition" actually refers to inflows that might have been experienced in the recent past. Later in the report (page 14, column 1, paragraph 2, for example) "current conditions" are revealed to actually be a theoretical construct combining maximum permitted water use for water flowing into Lake Livingston and actual water use for watersheds below Lake Livingston. While this comparison has some use in the analysis, the term "current conditions" is somewhat deceiving since it suggests a condition that is not actually encountered. Renaming the scenario to make it more obvious to readers that it does not represent actual inflow conditions would ease this problem. Why not call it "maximum permitted current conditions" to remind readers that the scenario includes maximum permitted water use upstream of Lake Livingston and current water use downstream. Some note of this complication should be added in the brief one-sentence definition of "current conditions" on page 1.

Page 9, column 1, second paragraph concerning scenarios. Again, the complications concerning the "current condition" scenario are not presented as accurately as they should be. "Current conditions" are depicted only as 1997 water

use diversions in the brief definition. While this is accurate for the region below Lake Livingston, it is not accurate for the flows coming from Lake Livingston which are apparently adjusted for "future full development of existing water rights" according to information on page 13. It would improve reader's understanding of the "current condition" scenario if it were named more appropriately ("maximum permitted current conditions") and defined here to specifically include the "future full development" flow conditions above Lake Livingston.

The brief definition of current conditions states "Year 1997 water usage conditions" yet the top paragraph in the second column of page 9 states year 1998 water diversions are used. A reader may find this difference confusing.

Page 13, column 2, second and third paragraphs. The introduction to this section of the report (first paragraph of column one on page 13) leads the reader to think that sections 5.1, 5.2, and 5.3 will include some information about how naturalization of streamflows was achieved. All three sections include information about this topic but Section 5.3 only discusses naturalization of Trinity River Basin flows downstream of Lake Livingston. The last paragraph on page 13, column 2 states that "Model inflows into Lake Livingston are not naturalized flows" and refers to a 1997 Trans-Texas Water Program report that is referenced in Table 5 on page 14. The description of the streamflow data source in Table 5 for the Trinity Basin specifically notes the information is for the region "below Lake Livingston." Consequently, there does not appear to be any information about naturalization of streamflows into Lake Livingston. It is not clear to readers whether the flows to Lake Livingston for the naturalized scenario are actually naturalized or are the "future full development" flows used in the other two scenarios.

Page 14, column 1, first paragraph. The period covered by the three scenarios is 1946-1980 yet line 4 of this paragraph notes that the record was extended through 1981. Is this just a disagreement of dates or is there other data that is available but has not been presented? The same sentence in this paragraph alludes to "making appropriate adjustments" to approximate current conditions. This general and unspecific statement of methods for adjusting the flows piques the reader's interest and makes him wonder what the adjustments are. The addition of a few sentences about the adjustments could provide useful information to satisfy the reader's curiosity.

Page 14, column 1, second paragraph. This paragraph makes the point that the "current" and "future" scenarios assume full development use of water upstream of Lake Livingston. This information should be included in the brief definitions of "current" and "future" scenarios on pages 1 and 9.

Page 17, column 1, third paragraph. The paragraph on Interbasin Transfer refers to a total of two surface water interbasin transfers being simulated. There were numerous interbasin transfer alternatives as part of the TTWP, SE area. It is unclear why only two were used. There may be a good reason for the ones selected, such as feasibility assessment, however, that is not clear. The report continues to refer to the

"GBFIG model," even though we are not aware that GBFIB developed a model. In the next paragraph on that same page (section 6.3), the authors refer to "The WRAP3 model used in the GBFIG study." That reference confuses the issue of which model was used and who developed it. That issue needs to be clarified in the final report.

Page 19, Table 7. The return flow factor for municipal non-COH and industrial return flows closely match return flow factors calculated by the TWDB for the Trinity Basin. However, the irrigation return flow factor (0.55) is substantially higher than values TWDB staff have calculated. A 1970's study by TDWR in the Matagorda Bay area estimated irrigation return flow factors (flow returned to estuary divided by diverted flow) at about 0.10. Data from four fields in Jefferson, Chambers, Brazoria, and Wharton counties by the Texas Agricultural Experiment Station comparing volumes in runoff collection ditches with water directly applied to fields plus rainfall showed return flow factors of 0.44. This does not take into account canal losses between the diversion point and the field nor losses between the runoff collection ditches and the river or estuary into which the returns flow; these losses would decrease the return flow factor even further.

Page 19, column 2, second paragraph. From the information presented in the paragraph, we assume that the implication is that the 1.04 and 0.85 return flow factors were applied only to the returns flows in the Buffalo Bayou and San Jacinto River subwatersheds. This could be stated more directly.

Page 21, column 1, lines 19-21, "Total inflows in these years were significantly above the norm." The period this study has chosen as the period of record is 1946-1980. A claim is made that some periods for which hydrology information was prepared by the Bay and Estuary (B&E) Program study had flows significantly above the norm. A question that can be posed is, what is the "norm?" One way of looking at this is to consider a longer period of record. Unfortunately, data on inflows to the estuary beyond the period 1941-1990 are not available. However, daily river flow data for the Trinity River at Romayor are available between 1925 and 1997. A quick comparison of the stream flow data with the 1941-1990 B&E inflow data shows there is a very good correlation between Trinity River flow and inflow to Galveston Bay (correlation coefficient = 0.931, $p < 0.0001$). About 87% of the variance in inflows to the estuary can be attributed to Trinity River flow, which makes a very good regression relationship. Thus, by looking at differences in Trinity River flow at Romayor for different time periods it is possible to get a better idea of what the "normal" inflow would be. The table below shows the mean, median, minimum, maximum, and standard deviation of annual flows for several time periods.

Statistic	1946-1980	1942-1989	1941-1990	1925-1997
Mean	4827963	5226082	5442044	5628813
Median	4677551	5041696	5255203	5413032
Minimum	917275	917275	917275	917275
Maximum	11886239	12277112	12277112	12784147
S.D.	2824037	2828635	2969885	2963488

Four periods were selected for the table: 1946-1980 is the period of record of this study; 1942-1989 is the period which includes two additional wet periods according to this study; 1941-1990 is the period for which B&E inflows are available; and 1925-1997 is the maximum period for which whole years of data are available. In each of the periods that are longer than 1946-1980, the mean Trinity River flow at Romayor increases. In each of the periods that are longer than 1946-1980 the median flow increases. For both of these measures of central tendency, the longer the period, the greater the mean or median. The minimum values do not change and the maximum values increase only slightly as the period of record is increased. Finally, the standard deviation increases only slightly with longer records and decreases as a percent of the mean or median with longer records. Using the 1925-1997 Trinity River flows at Romayor allows a period of 73 years of flow to be examined as opposed to only 35 years for the 1946-1980 flows. Assuming that a longer period of record provides a better estimate of the "normal" flow circumstance, one must conclude that the period 1946-1980 is actually a period of lower than usual flows. The mean river flow during the 1946-1980 period is 800,850 acre-ft less than during 1925-1997 and the median is 735,481 acre-ft less. Thus, the period that has been chosen as the period of record in this study (1946-1980) is not as representative of the flow regime that would be expected by examining a longer period of record as any of the other choices in the table above. On this basis, an average inflow of 10.1 million acre-ft per year appears to be a better estimate of a "normal" inflow than the lower 9.04 million acre-ft that is presented in the report.

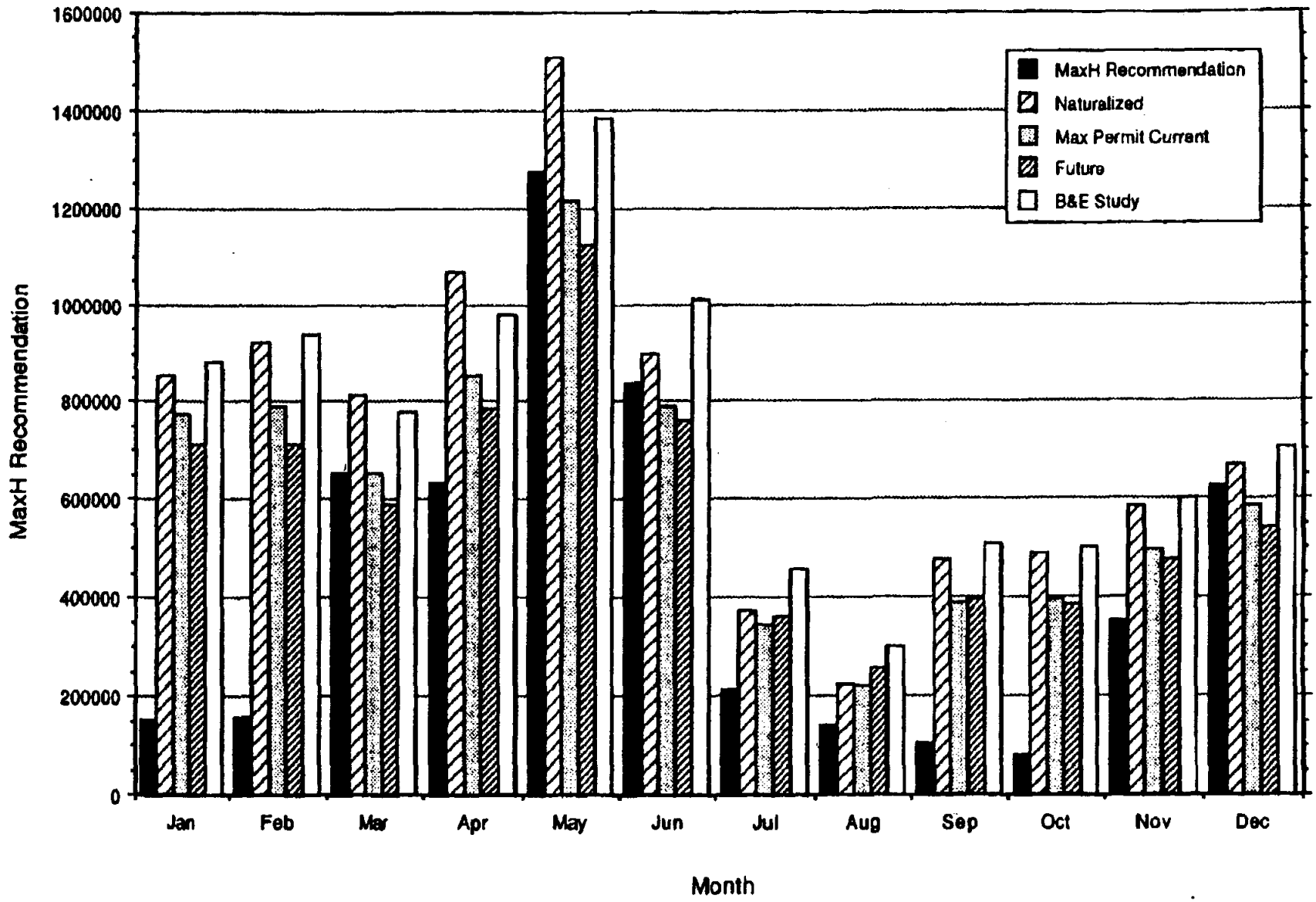
Since a number of the conclusions in the report are based upon the assumption that the 1946-1980 period is more representative of the normal inflows to the estuary than other periods, it might be useful to put the 1946-1980 flow values into the perspective of a longer period record. This might reveal that achieving the 5.22 million acre-ft inflow requirement is not as difficult under the development scenarios as the more limited period (1946-1980) statistics suggest.

Page 25, Table 13. The percentages for the B&E Maximum Harvest Inflow condition should be 24% (24.42%) for May and 2% (1.51%) for October.

no month are MaxH flows greater than the median flow based on the measured period of record of 1941-1990. Six months of the MaxH recommended flows are at the 1941-1990 median (March, April, May, June, November, and December) while recommended flows for the remaining six months are below the median value. If this information is combined with the comment about what is "normal" from the page 21 comment above, it appears that the "current" and "future" scenario flows presented in this report may be somewhat lower than they would be if a longer period of record had been used to establish "normal" conditions. Thus, the recommended MaxH inflow can already be satisfied in January, February, April, July, August, September, and October. It can be satisfied in March under the "current" scenario and possibly under the "future" scenario if "normal" conditions have higher inflows. The only three months that are uncertain are May, June, and December. Higher inflow averages in those months, as may be indicated by a longer period of record, could ease the water supply problem. Even if inflow values were not greater than the "current" or "future" values in those months, the deficiency range is only 10-15%, which may be within the range of error of the entire analytical technique and which may be an acceptable deviation from the optimal pattern.

General comment. The assumptions for the different flow scenarios are included in the report but discussion of them is somewhat fragmented. Assumptions about the conditions for a scenario are given at various places in the report only to be modified or added to later in the document. We suggest defining the scenarios completely early in the report so that readers do not have to keep adding to their understanding of the assumptions for each scenario.

Galveston Bay Inflow Comparison



April 22, 1998

Mr. Gordon Thorn
Director, Research and Planning Funds Management Division
Texas Water Development Board
P.O. 13231
Austin, TX 78711-3231

Regarding: Trans-Texas Water Program "Galveston Bay Freshwater Inflows Assessment", April 22, 1998

Dear Mr. Thorn,

The project team has reviewed comments on the referenced draft report submitted by the Texas Water Development Board. The report has been substantially revised to address the Board's comments and those of other respondents.

Thank you for your careful review of this report.

Sincerely,

Jeff Taylor
Project Manager

April 17, 1998

Mr. Jeff Taylor
Brown & Root, Inc.
P.O. Box 3
Houston, TX 77001-0003

Re: Galveston Bay Freshwater Inflows

Dear Mr. Taylor:

Staff of the Texas Parks and Wildlife Department have received and reviewed the above referenced report and have comments to offer (attached). With the suggested modifications discussed in yesterdays meeting and outlined here, the reported results will be clearer and more understandable.

It has been a pleasure working with you and the other South East Trans-Texas participants. The amount of time, energy and patience invested in this process will have been worthwhile as we move forward in the regional planning process. We look forward to continuing our work with the Region H and I Planning Groups to identify the most cost-effective and environmentally sensitive water management strategies to ensure safe, adequate water for all Texans.

If you have any questions, please contact me at (512) 912-7015.

Sincerely,

Cindy Loeffler, P.E.
Water Resources Team Leader
Resource Protection Division

CLL:cll

attachments

RECEIVED
APR 21 1998
By

4200 SMITH SCHOOL ROAD
AUSTIN, TEXAS 78744-3291
512-389-4800
www.tpwd.state.tx.us

Galveston Bay Freshwater Inflows Study

Title page
Consider renaming the report to "Water Availability Study with Comparisons to Galveston Bay Freshwater Inflow Targets".

Page 3
Delete reference to "nonliving organisms".

Page 5
Correct ratios for June (24%) and October (2%).

Page 7
3.1 Model Selection and Configuration.
Replace:
"Freshwater inflows to Galveston Bay were modeled..."
With:
"Water theoretically available as freshwater inflows to Galveston Bay were modeled..."

Insert the word "theoretically" :
"The control points illustrate the quantity of water *theoretically* in existence..."

Page 9
Does "Naturalized conditions" include return flows or effects due to dams?

The "Current conditions" definition on page 24 is more complete and accurate.
"Inflow conditions can be compared to Galveston Bay B&E analysis *results.*"

Page 13
Give equation for how flows are naturalized.

Page 14
Explain " appropriate adjustments to approximate current conditions".

Page 17
Correct spelling "Unappropriate Streamflow".

Page 19
Include a table with amounts of return flow under the 3 scenarios and give location of return flows.

Page 21
Replace:
"Second significant distinction ....B&E Study which computed historical flows."
With:
"Second significant distinction ....B&E Study which computed freshwater inflow targets based on historical flows."

Page 22
Replace:
"On average, current condition inflows into the bay are approximately 7.5 million acre-feet."
With:
"On average, current condition scenario results show approximately 7.5 million acre-feet of water is theoretically available"

Page 23:
"Inflows increased over time in the months of Jan-Feb, May, and July-Sept."
Absolute inflows for these months (acre-feet/month) decreased. Table 13 indicates the above statement is true for relative percentage of flow for Feb, June and July-Sept.

Delete Table 8. Include in the labels for Tables 9, 10 and 11 "Water Theoretically Available Under...", include units in the table headings (Acre-Feet/Month) and delete the MaxH boxes. Include a new table with monthly MaxH targets and new percentile ranking under the three scenarios.

Page 27:
"Monthly distribution of flows that have historically occurred.... would have to change.."
B&R should look at duration-frequency of flows on a monthly basis and compare the percent of time May target inflows are met under all scenarios, using Naturalized as the baseline case.

Delete "due to potential magnitude of necessary modifications needed to achieve inflows distribution target."

Delete or modify last conclusion: "Drought conditions may not be as harsh as historically occurred." Drought conditions may be less or *may be more* harsh. If this conclusion is really directed to the issue of increased return flows, address that issue. Also need to address the issue of return flows being returned at new locations in the future i.e. redirecting flows from Trinity Basin to San Jacinto Basin.

Recommendations:
TWDB should run the hydrodynamic model (TxBlend) for the three water availability

scenarios (naturalized, current and future) and then TPWD/TWDB should evaluate the resulting monthly salinity gradients output for geographic/spatial effects on ecosystem, especially fixed communities like oyster reefs and wetlands.

The State B&E program (TWDB/TPWD) should evaluate the of effects of reduced inflows (e.g. Less than MinQ) on biological production, when inflows are reduced over several years in a row (e.g. As in drought, 3-4 years). Special emphasis could be placed on examining particularly monthly effects from reduced inflows in spring (April-June).

April 22, 1998

Ms. Cindy Loeffler
Water Resources Team Leader
Texas Parks & Wildlife Resource Protection Division
4200 Smith School Road
Austin, TX 78744-3291

Regarding: Trans-Texas Water Program "Galveston Bay Freshwater Inflows Assessment", April 22, 1998

Dear Ms. Loeffler,

The project team has reviewed comments on the referenced draft report submitted by the Texas Parks and Wildlife. The report has been substantially revised to address these comments and those of other respondents.

Thank you for your careful review of this report.

Sincerely,

Jeff Taylor
Project Manager

Impact of Potential Toledo Bend Operation Changes

TEXAS WATER DEVELOPMENT BOARD

November 17, 1997

Mr. Tom Gooch
Freese & Nichols
4055 International Plaza, Ste. 200
Fort Worth, Texas 76190-4895

Re: Texas Water Development Board (Board staff) Comments on Trans-Texas Water Program "Impact of Potential Toledo Bend Operational Changes, April 1997

Dear Mr. Gooch:

Board staff has reviewed the above-referenced report and offer the following comments shown in Attachment 1.

Board staff hopes that these comments are of benefit to you and should you have any questions please call Gordon Thorn at (512) 463-7979.

Sincerely,

Tommy Knowles
Deputy Executive Administrator
for Planning

TEXAS WATER DEVELOPMENT BOARD

February 4, 1998

Mr. Tom Gooch
Freese & Nichols
4055 International Plaza, Ste. 200
Fort Worth, Texas 76190-4895

Re: Texas Water Development Board (Board staff) Comments on Trans-Texas Water Program "Impact of Potential Toledo Bend Operational Changes"

Dear Mr. Gooch:

The above referenced report has been received and reviewed by the Board's staff. The revisions to the report are acceptable and conform to the terms of the contract.

The Board looks forward to receiving one (1) unbound camera-ready original and nine (9) bound double-sided copies of the Final Report on this planning project. Please contact me at (512) 463-7979 if you have any questions concerning the project.

Sincerely,

Gordon L Thom

Gordon Thom, P.E., Director
Research and Planning Funds
Management Division

RESPONSE TO COMMENTS

Response to Comments from TWDB:

Three paragraphs were added to the end of Section 4.1 to address the preliminary qualitative analysis of the effects of Toledo Bend's operational change on recreational use, fisheries, and other instream uses in the Sabine River as well as the salinity, fisheries, and other resources in Sabine Lake.

Water Conservation

March 10, 1998

Mr. Jeff Taylor
Brown & Root, Inc.
P.O. Box 3
Houston, Texas 77001-0003

Re: Texas Water Development Board (Board staff) Comments on Trans-Texas Water Program "Water Conservation" January 30, 1998

Dear Mr. Taylor:

Board staff has reviewed the above-referenced report and offer the following comments shown in Attachment 1.

In addition, the incomplete tasks that are identified in the comments need to be completed in order to receive full reimbursement for those tasks.

The Board looks forward to receiving one (1) unbound camera-ready original and nine (9) bound double-sided copies of the Final Report on this planning project. Please contact Mr. Gordon Thorn, Director, Research and Planning Funds Management Division, at (512) 463-7979, if you have any questions about the Board's comments.

Sincerely,

Tommy Knowles
Deputy Executive Administrator
for Planning

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MAR [illegible] 1998
By_____

ATTACHMENT 1

TEXAS WATER DEVELOPMENT BOARD

COMMENTS ON TRANS-TEXAS WATER PROGRAM
"WATER CONSERVATION"

1) The City of Houston study city on page 10 projected an annual average reduction in water use of 24,700 acre-feet in the year 2050 due to advanced conservation while the Board projected a savings of approximately 64,000 acre-feet. This difference is due to the fact that the City of Houston study considered only savings by the City while the draft final report compares this to the net savings of the entire study area. The 1997 Texas Water Plan estimates savings by the City of Houston, 24,000 acre-feet per year in the year 2050, compares well with the City of Houston report. This needs to be corrected in the draft final report.

2) Task 2.1.3 -- "produce a table of baseline water demands with conservation 1990 - 2050 for the TTWP Southeast Area, by basin, by county" has not been fulfilled by any of the tables in Appendix A. These tables do not break down the baseline water demands to the county level.

3) Task 2.2 -- requires estimating water demands for the Houston SMSA by user types; determining interior versus exterior water demands; determining average versus peakday demands; and using these data to produce water demand profiles for 1990 -2050 for the Houston SMSA by county and basin. There is no discussion or tables showing that these determinations have been made.

4) Task 2.3 -- requires using TWDB's list of BMPs (Best Management Practices) in analyzing water savings and cost to implement each BMP. However, the consultant has used, and cited, the City of Houston's BMPs. A comparison of Houston's BMP's to TWDB BMP's is needed.

5) Task 2.3 -- requires using three scenarios for analyses delineated by subtasks 2.3.3, 2.3.4, 2.3.5, and 2.3.6. These scenarios are to include TWDB's "most likely" and "accelerated" conservation scenarios, as well as an additional scenario created by the consultant (based on market forces and presented by county and basin). The TWDB scenarios are not mentioned and the implementation analyses delineated by the above referenced subtasks do not appear to have been done. The one scenario presented is not broken down to county level. The report offers only Appendix E (excerpts from Houston's Final Draft Water Plan), a one-page discussion on implementation costs, and Table 6 (a large-scale summarization of the single scenario, amortized over time).

April 14, 1998

Mr. Gordon Thorn
Director, Research and Planning Funds Management Division
Texas Water Development Board
P.O. 13231
Austin, TX 78711-3231

Regarding: Trans-Texas Water Program "Water Conservation", January 30, 1998

Dear Mr. Thorn,

The project team has reviewed comments on the referenced draft report submitted by the Texas Water Development Board. We understand that comments were based upon an out-dated scope of services for this task and we note that in our response.

Responses to specific comments are:

Item 1. The Water Conservation report focus on the Houston Metro area which is defined as an eight-county area in the Houston/Harris County area. All estimates of projected conservation savings are based upon this geographic area with City of Houston estimates included for comparison purposes.

Item 2. Not in current scope of services.

Item 3. Not in current scope of services.

Item 4. Not in current scope of services.

Item 5. Not in current scope of services.

Thank you for your careful review of this report.

Sincerely,

Jeff Taylor
Project Manager

Desalination

TEXAS WATER DEVELOPMENT BOARD

March 18, 1998

Mr. Jeff Taylor
Brown & Root, Inc.
P.O. Box 3
Houston, Texas 77001-0003

Re: Texas Water Development Board (Board staff) Comments on Trans-Texas Water Program "Desalination Report". February 20, 1998

Dear Mr. Taylor:

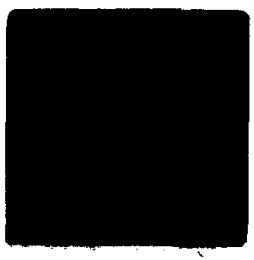
Board staff has reviewed the above-referenced report and offer the following comments in Attachment 1.

The Board looks forward to receiving one (1) unbound camera-ready original and nine (9) bound double-sided copies of the Final Report on this planning project. Please contact Mr. Gordon Thorn, Director, Research and Planning Funds Management Division, at (512) 463-7979, if you have any questions about the Board's comments.

Sincerely,

Tommy Knowles
Deputy Executive Administrator
for Planning

	Michael D. Rozell, Judge	Fort Bend County
	Allen Owen, Mayor	Missouri City
	Tom Condon, Jr., Vice President	The BETZ Companies
	Raymond R. Betz	The BETZ Companies
Environmental Analysis for the Neches Salt Water Barrier	Tommy Knowles, Deputy Executive Administrator for Planning	TWDB
	Richard Peterson, Superintendent	Big Thicket National Preserve
	Cindy Loeffler, Team Leader	Texas Parks and Wildlife, Water Resources
	Saul Aronow	Golden Triangle Sierra Club
Environmental Analysis for Potential Transfer Routes	Tommy Knowles, Deputy Executive Administrator for Planning	TWDB
Contractual Transfers	None Received	
General Comment	Patty Neild, Board Member	LNVA
	Mike Doguet	Doguet's Rice Milling Company
	Bill Dishman, Jr.	Citizen



Planning Information Update Report

c: Jeff Taylor
f

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Habitat Conservation Division
4700 Avenue U
Galveston, Texas 77551-5997

November 4, 1996

AG

Mr. Albert Gray
Sabine River Authority
Post Office Box 579
Orange, Texas 77630

Dear Mr. Gray:

We have reviewed the two reports titled *Planning Information Update* and *Phase II Program Update*, dated October 2, 1996, for the Southeast Technical Advisory Committee, Trans-Texas Water Program. We find the reports well prepared and very informative and have no comments at this time.

We appreciate this opportunity to offer our comments and if there are any questions, please call Mr. William Jackson of our office at: 409.766.3699.

Sincerely,

Rusty Swafford
Branch Chief
Galveston Field Branch

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

OCT 21 1996

Mr. Albert Gray AG
Sabine River Authority
P.O. Box 579
Orange, Texas 77630

Dear Mr. Gray:

Thank you for the opportunity to review the Trans-Texas Water Program reports: **Planning Information Update** and **Phase II Program Update.** The reports were transmitted to the Environmental Protection Agency (EPA) with your transmittal memo dated October 2, 1996.

Members of my staff in the Public Water Supply Supervision and Ground Water Protection programs have reviewed the reports and find them most informative and useful. We have no other comments on the contents of the reports.

We look forward to reviewing any future technical studies that the Trans-Texas Water Program committees are preparing. In particular, we would be interested in reviewing any studies conducted related to desalination and wastewater reclamation. These topics focus on a concern that may exist in several areas of EPA Region 6 (Texas, Oklahoma, Louisiana, New Mexico, and Arkansas) and we are always seeking additional technical studies for our information and use.

Once again, thank you for the opportunity to review these documents and should you have any questions about EPA's role in protecting the nation's water resources, please call me at (214) 665-7150.

Sincerely yours,

Larry Wright

Larry Wright
Acting Chief
Source Water Protection Branch

Brazos River Authority

QUALITY • CONSERVATION • SERVICE

June 4, 1996

Mr. Jeff Taylor
Brown & Root, Inc.
P.O. Box 3
Houston, Texas 77001-0003

Re: Comments on *Planning Information Update Report*

Dear Jeff:

I have reviewed the referenced report and have the following comments:

1. On Page 8, it is stated that "Projections indicate the Brazos basin has the greatest increases of population, reflecting substantial growth in Fort Bend County." This statement does not reconcile with the population projection details shown in Appendix B. The table labeled "San Jacinto Basin" indicates that Fort Bend County population growth is taking place in the San Jacinto basin and not in the Brazos River basin. Even with these corrections, the absolute increase in population for Fort Bend County does not compare to the absolute increase for Harris County. Comparatively, the statement referenced above would give more weight to the Fort Bend population than is justified. I would suggest discussing the population growth rate for Fort Bend County but include a comparison with Harris County's estimated 2050 population estimate.

2. On Page 28, in Section 5.3, an increase in existing groundwater supplies is noted. It is not clear that the 70,000 acre-feet per year is from increased supplies in the Brazos basin. If a substantial portion of this groundwater supply is from the Brazos basin, please specify the aquifer source.

Thank you for the opportunity to review the referenced report. If there are any questions, please do not hesitate to contact me.

Sincerely,

J. TOM RAY, P.E.
Planning and Environmental
Division Manager

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4400 Cobbs Drive • P.O. Box 7555 • Waco, Texas 76714-7555
817-776-1441 • FAX 817-772-5780

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Ecological Services
17629 El Camino Real, Suite 211
Houston, Texas 77058

October 17, 1996

Albert Gray
Sabine River Authority
P. O. Box 579
Orange, Texas 77630

Dear Mr. Gray:

We have reviewed the draft Planning Information Update for the TTWP, Southeast Texas Area. Our concerns are for a water supply strategy that includes a consideration of adequate water for streamflow fishery management and adequate estuarine inflow to conserve the bay fisheries at levels considered appropriate by resource agencies.

On page 9, the update concludes that environmental water needs are considered non-consumptive. This would be the case for reservoir water and river water upstream of the lowermost reservoir but not for river water used to maintain proper salinities and nutrients for the estuary. This water is consumptive and should be included in calculations of demand along with other needs.

The memorandum also concludes that environmental water needs will be met prior to the identification of any remaining new supplies. If Toledo Bend is considered an existing supply, then one could conclude that environmental needs will not be considered at all. There are no other practical new water supplies in the future, excepting desalinization, as evidenced by the economics of past water investigations.

Wallisville Dam will allow complete utilization of Lake Livingston and run of the river water below this reservoir. Service support for this project is predicated upon a water supply strategy that includes providing maintenance water to the Trinity River from upstream supplies or interbasin transfers. This requirement needs to be included in the specific water allocation strategy recommended by this program.

The Service urges strong consideration of environmental water needs coincidental with other Southeast Texas water needs.

Thank you for the opportunity to comment on the Phase II report.

Sincerely Yours,

FOR Will Roach
Acting Field Supervisor

TEXAS WATER DEVELOPMENT BOARD

JWT

Bambi - Copies To
Jeff Taylor
Tom Gooch

August 10, 1995

AG

Mr. Albert Gray
Sabine River Authority
P. O. Box 579
Orange, Texas 77630

Jeff - Let's Discuss.
AG

albert

Dear Mr. Gray:

The Texas Water Development Board(Board) staff has reviewed the Enhanced Public Participation Study, the Planning Information Update Report, the Status of Environmental Issues for Allens Creek Reservoir and the Operations Studies and Opinions of Cost for Allens Creek Reservoir and offer the following comments:

1. **The groundwater availability numbers for the Houston metropolitan area are likely significantly overstated and were developed from a different source and utilized on an inconsistent basis with the Board demand forecasts used elsewhere in the Southeast study area analysis. These groundwater availabilities were developed on the basis of the high demand forecasts from the Harris-Galveston Coastal Subsidence District's(District) 1989 report. Applying the new and lower Consensus Water Plan demand forecasts to each zone's conversion policy will likely have a noticeable effect in reducing groundwater availability. It is our understanding that even the District's new demand forecasts, still in draft form, are noticeably lower than their previous study's forecast used as the basis for groundwater availability in the draft Phase II Southeast study area report.**

2. **It is also the opinion of the District that the 90%/10% SW/GW policies in Zones 1 and 2 have had and will have the effect of placing most past and nearly all future demand upon surface water for these zones.**

ATTACHMENT 1

TEXAS WATER DEVELOPMENT BOARD

COMMENTS ON TRANS-TEXAS WATER PROGRAM "DESALINATION REPORT"

Citations to references were handled poorly, and in most instances are missing. References need to be cited in the text.

Tables 1 and 2 on pages 8 and 9 respectively provide a nice summary.

The following comments are organized by page number:

Pg. 1, par. 1 - The seven water management alternatives should be listed.

Pg. 5, Mechanical Processes, par. 4 - A range of 200 to 500 psi is given for reverse osmosis (RO). This information may be dated, as there is at least one pilot project operating at pressures of about 100 psi.

Pg. 12, Location, Schedule, and Quantity of Need, last paragraph - The paragraph is negative with respect to large RO plants and infers that a 70 mgd plant, such as the one in Yuma, AZ, has excessive capital, operations and maintenance costs. This paragraph is in contrast with the statement attributed to the "Office of Technology Assessment reports" on Pg. 17 that the unit production costs (per gallon) are only 10 percent less for a 100-mgd RO plant compared to a 10-mgd plant.

Pg. 13, Brackish Groundwater Sources, first paragraph - This paragraph includes the statement that were brackish groundwater to be pumped from the lower Evangeline aquifer, the potential risk for increased subsidence is great. While this statement may be true, it would be better to recommend specific analysis of the Evangeline aquifer including modeling to determine if large withdrawals of brackish groundwater would cause subsidence. Depending on the type of hydraulic connection to the Gulf and the location of the wells, subsidence may not be a concern.

Pg. 13, Desalination Facility Design, par. 3 - What is the basis for assuming a well capacity of 1000 gpm and a spacing between wells of 1500 ft?

Pg. 16, Land Subsidence Impacts, last paragraph - The report cautions that withdrawals from the Jasper aquifer have the potential for further land subsidence if the compressible clays within the Burkeville aquiclude compact and recommends more detailed hydrogeologic analysis. This is consistent with the above comment regarding additional analysis of the Evangeline aquifer. In effect the report should recommend that both the Jasper and Evangeline aquifers be analyzed with respect to land subsidence.

Pg. 17, General Cost Overview, par. 1 - A citation is made to Office of Technology Assessment (1987). This report should be included in the References section.

Pg. 18, Brackish Groundwater Desalination Cost, first paragraph - The report gives an average annual water cost of approximately $1270 per acre-foot, which seems high. What is the assumed operational psi?

Pg. 19, Brackish Groundwater Desalination Cost, last paragraph - List the other TTWP water strategies.

April 14, 1998

Mr. Gordon Thorn
Director, Research and Planning Funds Management Division
Texas Water Development Board
P.O. 13231
Austin, TX 78711-3231

Regarding: Trans-Texas Water Program "Desalination", February 20, 1998

Dear Mr. Thorn,

The project team has reviewed comments on the referenced draft report submitted by the Texas Water Development Board. This technical memorandum is one of several feasibility level investigations undertaken by the Southeast TTWP. It investigates, at a conceptual level, desalination as a water management alternative, evaluating its potential use in the Southeast Area in relation to the overall TTWP management program. We acknowledge that detailed study will be necessary before any project could be proposed. This report does not purport to serve as a definitive examination of a specific desalination project but rather as a preliminary investigation of the issues and conditions associated with brackish groundwater desalination in the Harris/Galveston County.

The estimated costs shown in the report reflect current desalination industry cost values. Operational and maintenance costs of desalination treatment plants are simply high. None of the currently available literature suggests that these facilities could have significantly lower O&M costs.

Your suggestions that additional study of the Evageline and Jasper aquifers be undertaken is excellent. Potential land subsidence is a real concern that can only be reconciled through extensive study. Such study and modeling will be necessary before any brackish groundwater project can be recommended.

Thank you for your careful review of this report.

Sincerely,

Jeff Taylor
Project Manager

Systems Operations of Surface Water Supply Sources in the Houston Area

March 6, 1998

Mr. Tom Gooch
Freese & Nichols
4055 International Plaza, Suite 200
Fort Worth, Texas 76109

Re: Texas Water Development Board (Board staff) Comments on Trans-Texas Water Program "System Operation of Surface Water Supply Sources in the Houston Area", November 1997

Dear Mr. Gooch:

Board staff has reviewed the above-referenced report and offer the following comment:

> Section 4.3.7 of the Scope of Services states that preliminary estimates of the cost of facilities and operation required for system operation would be developed. These cost estimates were not included in the report.

The Board looks forward to receiving one (1) unbound camera-ready original and nine (9) bound double-sided copies of the Final Report on this planning project. Please contact Mr. Gordon Thorn, Director, Research and Planning Funds Management Division, at (512) 463-7979, if you have any questions about the Board's comments.

Sincerely,

Tommy Knowles
Deputy Executive Administrator
for Planning

3/31/98
To: MEMBERS, SOUTHEAST POLICY MANAGEMENT COMMITTEE, AND
TECHNICAL ADVISORY COMMITTEE TRANS-TEXAS WATER PROGRAM
Re: WATER CONSERVATION REPORT DRAFT
Patty Neild
1256 Moore Road
Beaumont, Texas 77713
Member Board of Director's Lower Neches Valley Authority

For every gallon of water inventoried and projected in this study, there is ten times that amount falling on Texas annually. A great deal of space and emphasis was given to smaller toilets and the impact they have on usage in the Houston metropolitan area. Also, great concern for washing and watering practices was highlighted as an indication that Houston is doing everything humanly possible to conserve the water in their basin. The basic premise assumed in the study is that as this water is exhausted interbasin transfer is the preferred long term solution to the needs of the Houston metropolitan area.

This study gave little effort to projecting the amount of water that could be collected annually from rainfall. This water is currently a lost asset of the State and a liability for many flood prone areas of Southeast Texas. The interbasin transfer option presumes that it is cheaper to trench and pump than to build reservoirs.

I guess the question is cheaper for whom. In the short shift some interbasin transfers might be necessary through existing canal systems but the long term best interest of both Houston and Southeast Texas is not served by a system of canals for interbasin transfers. In the long run such a system will leave everyone in need of water.

It seems to me that we are all best served by collecting the ever renewable asset rain in a series of reservoirs. These reservoirs may seem expensive now but in 50 years they will be a cheap investment in harnessing the water that currently runs to the Gulf often leaving behind destruction.

From: Wayne Tschirhart, Water Supplies Section
To: Tom Gooch
Date; January 27, 1998

Subject: Comments on draft Houston System Operations Report

The references on pages A-1, 5-1, 5-2, and 5-3 need to be checked. I found that some of the reference numbers did not correspond to the appropriate reports listed in Appendix A.

RESPONSE TO COMMENTS

Response to Comment #1 by TWDB:

Paragraphs were added to the end of Sections 7, 8, 9 and 11 that described the new facilities required and identified the cost of those facilities.

Response to Comment #2 by Wayne Tschirhart, Water Supplies Section of TNRCC:

All references were checked and if needed they were corrected.

Allens Creek Reservoir Environmental and Operations Studies

The Light company
Houston Lighting & Power

P.O. Box 1700 Houston, Texas 77251-1700 713-207-1111

January 8, 1997

Mr. Thomas Gooch, P.E.
Freese and Nichols, Inc.
4055 International Plaza, Suite 200
Fort Worth, Texas 76109-4895

Re: **Trans-Texas Water Program - Southeast Area**
Comments on Draft Memorandum Reports for Allens Creek Reservoir

Dear Mr. Gooch:

Members of Houston Lighting & Power Company's (HL&P) staff have reviewed the two draft memorandum reports prepared for the Trans-Texas Water Program concerning the proposed Allens Creek Reservoir: *Operation Studies and Opinions of Cost for Allens Creek Reservoir* (Operation Study) dated November 1996 and *Status of Environmental Issues for Allens Creek Reservoir* (Environmental Study) dated November 1996. The following comments are submitted for your consideration.

Comments on the Environmental Study

1. Copies of additional studies which contained information about wildlife and habitat at the proposed Allens Creek Reservoir site were sent to you last month. We feel that where appropriate this information should be incorporated into the final Trans-Texas report.

   - *Wildlife Habitat Appraisal for The Proposed Allens Creek Reservoir Site.* August 1995. Dr. James Lester of the University of Houston Clear Lake commissioned by Texas Parks and Wildlife Department.

   - *Biological Monitoring Program of the Allens Creek Nuclear Generating Station.* 1975. Dames & Moore Environmental commissioned by Houston Lighting & Power Company.

2. The title of Section 2 of the Environmental Study, "Affected Environment", should be changed to something less prejudicial. We suggest a more neutral title such as "Site Description" since the purpose of Section 2 is to detail the existing baseline conditions found at the site; whereas, Section 3 assesses how constructing a reservoir will impact the site.

3. The Operation Study proposes an alternative dam alignment to reduce wetlands mitigation costs, but this second design and the reduced impacts are only briefly mentioned in the Environmental Study. We believe that the Environmental Study should fully discuss this alternative.

4. During the recent meeting of the Technical Advisory Committee for the Southeast Area of the Trans-Texas Water Project, there were questions as to why the estimated acreage needed to mitigate the reservoir site differed so much between the Environmental Study and the Wildlife Habitat Appraisal prepared by Dr. Lester. Both reports contain similar area estimates for potential wetlands, but it appears that Dr. Lester based his mitigation estimates on mitigating all land inundated by a 8,250 acre reservoir, whereas, the Environmental Study assumes that only the jurisdictional waters of the U.S. impacted by a 8,250 acre and a 7,060 acre reservoir would be mitigated. We understand that under current law the reservoir developer must mitigate impacts to jurisdictional waters of the U.S. and that any additional mitigation would be solely at the discretion of the developer. If this is the case, it is inappropriate to include estimates for discretionary mitigation in cost estimates that will be used to compare this water management strategy with other strategies.

   Additionally, we question whether the statement in Section 4 (third paragraph) that the remaining area in the proposed reservoir area would require some mitigation is correct.

5. Both the Environmental Study and Dr. Lester's Wildlife Habitat Appraisal assume that all the environmental and ecological impacts will be negative. This assumption has proven false at the reservoir constructed adjacent to the South Texas Project in Matagorda County. HL&P constructed the 7,000 acre reservoir in the early 1980's and filled the reservoir with fresh water from the Colorado River. Annual waterfowl population counts conducted each fall from 1980 to 1986 showed a increase in the number and diversity of migratory waterfowl and native shorebird species. Annual Mad Island Marsh Christmas Bird Counts which are conducted at the STP Reservoir and neighboring land have continued to identify a wide range of species that have been attracted by the reservoir. Reports detailing these ecological studies are attached. In general, the ecological advantages of managed deep water habitat over farmlands include increased number and diversity of migratory waterfowl (i.e., ducks, loons, grebes), increased number and

diversity of native shorebird species, and a refuge for migratory waterfowl during drought cycles.

In addition, aquatic life habitat has not been addressed. Construction of a reservoir enables a well managed fishery to be established that will enhance the ecological value of the site, the recreational fishing activity, and general aquatic recreation activities.

HL&P believes that the positive environment and ecological impacts should be fully discussed in the Environmental Study and the value of these positive impacts be used to offset needed mitigation.

6. Will the reservoir dam design include relief well or some other mechanism for relieving the hydrostatic pressure of the reservoir on the dam? If so, could this water be used to enhance the wetland areas which lay between the reservoir and the Brazos River?

Comments on the Operation Study

1. The Operation Study is somewhat confusing. The main body of the study addresses the operation and costs associated with a 8,250 acre reservoir. Almost as an afterthought, an additional section was added which proposes an alternate dam alignment that would minimize the inundation of wetland areas. Since the outcome of evaluating this water management strategy would undoubtedly be significantly different depending on which of the two design options is considered, it is important that only one design be proposed for final review by the Trans-Texas Section Team so that all team members are evaluating the same project. Based on the material in these studies, HL&P supports the concept of realigning the dam to minimize disturbing established wetland areas. We suggest that the realigned dam design be the single design evaluated by the Trans-Texas Selection Team for the Allens Creek Reservoir; consequently, all the supporting operational studies, cost estimates, environmental impacts, and other materials should support this design. It seems more appropriate to discuss the two alternate designs and the advantages of the realignment in the report's Introduction, then focus exclusively on the one design in the body of the report.

2. The Operation Study does not address several of the criteria which will be used to evaluate the various Water Management Strategies. In particular, the study does not discuss a very important issue: the economic impacts of the reservoir to the surrounding communities. HL&P commissioned an economic analysis of the recreational value of the proposed Allens Creek Reservoir and State Park when we were planning an electric generating facility adjacent to the reservoir. The study, which is attached, concluded that

there would be an annual net benefit of at least $24 million (in 1985 dollars) from the direct use of reservoir and park facilities. In addition, the development of a dependable water supply will also impact the economic development of not only the surrounding communities, but also of the downstream communities in Fort Bend and Brazoria Counties. HL&P suggests that the economic impact of the reservoir be fully discussed in the final Study.

3. The Operation Report does not address operating the Allens Creek Reservoir and the other Brazos River Authority reservoirs as a system. Is it possible to optimize the yield from the Brazos River and the Allens Creek Reservoir by operating these reservoirs in a coordinated fashion?

We appreciate the opportunity to comment on these Studies. Should you have any questions about our comments, please contact Ms. Cynthia M. Schmidt at (713) 945-8214.

Sincerely,

Edward A. Feith, P.E.
Manager, Environmental Department

CMS/cms J:\ENV\WATERSUP\ALENS-CK\COMMENT1.WP6

Attachments

cc: Jeff Taylor

A CENTURY OF SERVICE

FREESE-NICHOLS

June 2, 1997

Mr. Edward A. Feith
Manager, Environmental Department
Houston Lighting and Power Company
P.O. Box 1700
Houston, Texas 77251-1700

Re: Trans-Texas Program Southeast Area
Allens Creek Reports

Dear Mr. Feith:

In January, you sent us a set of comments and suggestions relating to two draft memorandum reports on the proposed Allens Creek Reservoir. We felt that it would be appropriate to respond directly to your observations, so that you will know what changes we have made and also our reasoning where we do not believe changes should be made at this time.

Comments on The Environmental Study

1. General

Please note that this is only a status report on existing environmental conditions at the Allens Creek site. It is not meant to take the place of the environmental assessment, which will come later.

2. Additional Information on Wildlife and Habitat

Wildlife Habitat Appraisal for The Proposed Allens Creek Reservoir Site

Discussion was added to the Executive Summary and Section 4 - Permitting and Regulatory Issues. This discussion centers on the compensation requirements identified in the WHAP study.

Biological Monitoring Program of the Allens Creek Nuclear Generating Station

An additional section (Section 2.3.1 - Wildlife) was added to Section 2 to discuss more completely the environmental conditions within the proposed reservoir area.

Freese and Nichols, Inc. Engineers Environmental Scientists Architects
4055 International Plaza Suite 200 Fort Worth, Texas 76109-4895
817-735-7300 Metro 817-429-1900 Fax 817-735-7491

3. Title of Section 2

The title for Section 2 has been changed from "Affected Environment" to "Existing Environment."

4. Discussion of Alignment Change

Table 3-1 was added to Section 3.2 to demonstrate the differences in impacts and mitigation requirements with and without Alligator Hole.

5. Mitigation Acreage

Compensation acreage identified in the WHAP report would be required by Texas Parks and Wildlife Department for impacts to wildlife as a result of construction of the reservoir. Mitigation for impacts to wetlands and other jurisdictional waters would be required by the U.S. Army Corps of Engineers. It is hoped that mitigation acreage required by the Corps could be incorporated into the compensation acreage required by TPWD.

6. Positive Environmental/Ecological Impacts

Discussion was added to Section 3.3 (3.3.1 - Wildlife) to cover the shift in habitat types as a result of construction of the reservoir.

7. Relief Wells and Wetland Area Enhancement

Your suggestion is a good one if relief wells are in fact needed. However, that point will not be clear until the design phase, when there will be more detailed geotechnical work and decisions on the embankment configuration.

Comments on the Operation Study Report

1. Treatment of the Potential Alignment Change

This report covers several specific work tasks related to simulation of reservoir performance and a revised estimate of probable project cost, all of which are based on the project concept that has been proposed since at least 1974. The possibility that the environmental impact of the project could be significantly improved by realignment of the embankment and raising the storage level three feet without loss of performance or increase in total cost was recognized and explored after those other tasks were completed. Preliminary evaluations confirmed that the change would be basically beneficial, as shown

in Table 6-1 of the report. We think the sequence in which these findings are covered is valid and that it is more realistic to present the alignment change as an option than to take it for granted at this time. It is not a fundamental change, but rather a refinement at the detail level. We believe the report deals with it in a proper manner.

2. Impact on the Local Economy

This is more an environmental factor than something to be covered in the operation study report. We are adding discussion of this consideration in Section 4 of the environmental report.

3. Operation as Part of the Brazos River Authority System

The scope of work for the Trans-Texas studies refers to the Allens Creek project in the context of "a balancing reservoir in the Trans-Texas system." Its function as a component of the Trans-Texas program might or might not contribute directly to the Authority's system performance. Obviously, the Trans-Texas system as a whole would need to operate in a way that would be compatible with the BRA system, but it remains to be seen whether it would be closely coordinated with that system. As you know, this is a complex issue, and it was not included among the tasks budgeted for the present report.

Yours very truly,

FREESE AND NICHOLS, INC.

Thomas C. Gooch

Thomas C. Gooch, P.E.
Principal

[BRT94138]T:\LET\FEITH.TCG

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Ecological Services
17629 El Camino Real, Suite 211
Houston, Texas 77058

February 11, 1997

Albert Gray
Development Manager
Sabine River Authority
P. O. Box 579
Orange, Texas 77630

Dear Mr. Gray:

The U.S. Fish and Wildlife Service (myself and Bryan Pridgeon) has been participating on the SETAC to insure that TTWP planning will be consistent with any Federal environmental requirements and that fish and wildlife resource planning is included with other features of project development.

We have recently reviewed and completed a preliminary field evaluation of the Allens Creek Reservoir site near Wallis, Texas. The information contained in the environmental issues volume is quite comprehensive but we believe Figures 2.1 and 2.2 should be combined into one (or an overlay) cover type habitat map.

The action agency for this project should inspect the area for bald eagle nests and for the presence of Attwater greater prairie chicken at the time the detailed planning for construction begins. There are eagle nests across the Brazos in Fort Bend County and suitable habitat for prairie chickens was identified within the reservoir area.

Alligator Hole is a rather unique and interesting habitat. Mitigation for losses here would be extremely costly so the project should be designed around the alternative that avoids this area. A mitigation scheme for subsequent losses could be put in place in and around the Alligator Hole landscape to return value that has been lost from past agriculture. This could be done by an easement on the lands involved to conserve them as natural areas against deterioration and drainage for the future.

The operation of the reservoir for storing trans-basin water was not discussed in the document if this is the case. Would the reservoir be on the direct route of trans-Texas conveyance or re-allocation take place by withdrawal and discharge into the Brazos during pick up periods elsewhere? This requirements could affect design of the reservoir and consequential environmental impacts in the reservoir and river.

Thank you for the opportunity to comment. If you need any additional information please do not hesitate to contact me at 713/286-8282.

Sincerely,

Frederick T. Werner
Chief, Regulatory Activities

cc:
Glenda Callaway, TTWP Environmental Focus Group

AG

Don W. Hooper, Ph.D.
Office of the Superintendent

Copy To Tom Gooch
+ Jeff Taylor

January 28, 1997

Mr. Albert Gray
Coordinator, Trans-Texas Water Program Southeast Area
Sabine River Authority
P.O. Box 579
Orange, Texas 77630

Re: Proposed Allens Creek Reservoir

Dear Mr. Gray:

I understand that the Trans-Texas Water Program (Southeast Study Area) is considering the proposed Allens Creek Reservoir as a water supply option for meeting projected water demand in the State of Texas. As a local official I am in favor of the Allens Creek Reservoir because

- the Fort Bend Independent School District will ultimately need a dependable surface water supply
- future economic development in FBISD depends on the future availability of a dependable water supply
- the reservoir can store otherwise destructive flood water for constructive use during droughts
- the reservoir will have a positive economic impact on the school district due to increased recreation facilities and tourism
- the reserve will have a positive economic impact on the school district due to the potential for development and increased property value of the land surrounding the reservoir
- the reservoir will enhance the environment by replacing flood prone agricultural and grazing land with a reservoir that can support a large fish and bird population.

I urge you to give full consideration to the positive economic impact that the Allens Creek Reservoir will have on the local and regional economy and recommend it as a water supply project to the State.

Sincerely,

Don W. Hooper, Ph.D.
Superintendent

cc: County Judge
Brazos River Authority
The Greater Fort Bend Economic Development Council

Fort Bend Independent School District • 16431 Lexington Blvd. • Sugar Land, Texas 77479 • (713) 634-1006 • Fax (713) 634-1700
E-mail: dhooper@soho.ios.com! ••• World Wide Web: www.fortbend.k12.tx.us

Copy FP: Taylor TG

City of Meadows
One Troyan Drive
Stafford, Texas 77477
Tel (281) 983-2950
Fax (281) 983-2940

January 28, 1997

Mr. Albert Gray
Coordinator, Trans-Texas Water Program Southeast Area
Sabine River Authority
P.O. Box 579
Orange, Texas 77630

Re: Proposed Allens Creek Reservoir

Dear Mr. Gray:

I understand that the Trans-Texas Water Program (Southeast Study Area) is considering the proposed Allens Creek Reservoir as a water supply option for meeting projected water demand in the State of Texas. As a Local official, I am in favor of the Allens Creek Reservoir because:

The City of Meadows will ultimately need a dependable surface water supply.

Future economic development in the City of Meadows depends on the future availability of a dependable water supply.

The reserve will have a positive economic impact on the City of Meadows due to the potential for development and increased property value of the land surrounding the reservoir.

The reservoir will enhance the environment by replacing flood prone agricultural and grazing land with a reservoir that can support a large fish and bird population.

I urge you to give full consideration to the positive economic impact that the Allens Creek Reservoir will have on the local and regional economy and recommend it as a water supply project to the State.

Sincerely,

J. McDonald

Jim McDonald
Mayor

JM:eh

cc: County Judge Mike Rosell
Brazos River Authority
The Greater Fort Bend Economic Development

December 8, 1996

Albert Gray
Sabine River Authority of Texas
Box 579
Orange, Texas 77630

Dear Mr. Gray,

Enclosed is a copy of my personal comments regarding the TPWD's Legislative Summary for the State Water Plan.

My comments on the Allens Creek Project can be found here as well as other comments that address the Trans - Texas Plan. Please do send me a copy of Volume II of the Allens Creek Plan.

Thank you for your assistance.

Sincerely,

Brandt Mannchen

Brandt Mannchen
1705 Michigan #3
Houston, Texas 77006
H713-521-9534, W713-640-4313

December 8, 1996

Craig Pedersen
Executive Administrator
Texas Water Development Board
P. O. Box 13231
1700 N. Congress Ave.
Austin, Texas 78711-3231

Dear Mr. Pedersen,

Enclosed are my personal comments regarding the "Draft Water for Texas Today and Tomorrow - A Draft Legislative Summary of the 1996 Consensus - based Update of the State Water Plan".

1) I am concerned that the TWDB is talking to state legislators about what bills should be passed by the Texas Legislature and what should be in the bills. This one action virtually nullifies any possible impact the public, including myself, can have on this proposal. This is not true public participation since the outcome is already preordained. In essence this is sham public input. I object!

2) In reality the entire process is backwards. The Texas Water Plan update should come out first, the public should give their comments, and then the water plan finalized. By the time the water plan does come out the TWDB will have gotten much of what it wanted, without public input and scrutiny of the water plan because the Texas Legislature will have passed changes that TWDB pushed to have made. All this is being done again without the benefit of public input which can correct errors as well as bring additional information to the fore and prevent hasty actions that are not in the public's best interest. I object again!!

3) Since we have no inflow studies completed, as one example, how can we push for changes to water policy that will effect inflows when we cannot tell how the inflow issue will effect the water plan? The same can be said for the drought criteria. Without seeing what TWDB proposes and how the public feels about this how can legislation be passed that will change drought policy regarding overriding inflow protection? You in essence seek changes to obtain more power before you give the public the ability to see what you propose and judge it.

4) I certainly agree with Bill Moore of the San Jacinto River Authority that we need to have people take responsibility for their actions or inactions. This means that we need to start living within our means. In the Houston Area we have exceeded our carrying capacity. We exceed air quality standards so we are exceeding our airshed capacity, we exceed water quality standards so we are exceeding our water quality capacity, we exceed our watershed capacity to only use water in the basin where we live, we exceed our floodshed capacity since we have severe floods every year which cause millions of dollars of damage, we have exceeded our wildlife capacity since we have endangered species, depleted wildlife populations, and deteriorated habitat (very litte native prairie and bottomland hardwoods left, to name just two habitats that have severely deteriorated), we have exceeded our vegetation capacity by destroying so much of our native vegetation that erosion is having a maior impact on our human created systems, like dredging for navigation.

We need to start living within our means. Just because there have been interbasin transfers in the past does not mean we should have more of them. The magnitude of interbasin transfers being proposed are huge combared to what we have seen in the past. I do not believe that once water has been transfered that it can be cut off from the basin it has been transfered to. I believe those who say this are not being accurate or honest. I do not really believe that once Houston gets Trans - Texas in it will give the water back to East Texas.

We need to redirect our population growth to areas where we are not exceeding our water carrying capacity. We also need to reduce population growth and discourage additional people from moving here. We need to reduce our material usage. We do not need a doubled population. Trend is not destiny. We can plan for these things. If we do not talk about them and start the process then we will never come to grips with the growing forever cancer talk. This is not biologically possible or socially desirable or responsible.

4) I also am concerned that we are piecemealing the old Texas Water Plan. You do not show in the document the existing water transfer projects that are in place. If you overlay these with the ones proposed that are in your document you can very easily see that a canal or pipeline down to Brownsville and one to the Panhandle are not that farfetched from happening. The political momentum will be hard to resist once all of these projects are in place to go ahead and make some final connections. This would be disasterous for the environment and for people's livelihoods.

5) The economic emphasis of this plan scares me. Economic potential is not necessarily good for people. For instance, massive layoffs, in Texas and elsewhere, are good for economic potential for bondholders and stockholders as are movements to other countries of jobs. But they are devestating to our people who need the jobs here and now. In addition on page 2 this plan does not focus on economic viability because it does not take the attitude that overstripping our natural resource base is bad and that those jobs shipped out of Texas to other countries is not good. In addition on page 1 when you talk about reasonable cost for economic developement what does this mean? Is it reasonable to have socialistic intents to support wealthy persons or interests by subsidizing these with lots of water projects? Is this best for the public in the long run?

6) I continue to be worried that by TPWD signing on to this process and plan it has placed itself in an impossible position. I do not believe TPWD will have the leverage to stop unacceptable parts of this plan when it is so emeshed in the matrix of the plan. I do not beleive that TPWD will have the independent voice to stop foolishness within the process. The TPWD has an opportunity to do this outside the process where it can talk directly to the public and not be compromised by its entanglements within the process. This is a great concern that I have. Already the PR part of the process makes you wonder about its fairness and validity. This is not a concensus - based process when you do not allow the public to respond before you work with legislators about what changes are needed and when most meetings of the Trans - Texas project are held at times when the public cannot attend.

7) I am opposed to many of the water projects that are listed on page 6, Figure 5, In particular the Wallisville Dam will unacceptably impact the Trinity River Delta and is not necessary economically. The Allens Creek Dam really scares me since on page 1 - 1 of the Draft Memorandum Status of Environmental Issues for Allens Creek Reservoir. Trans - Texas Water Program Southeast Area, November 1996. when it says that "The proposed reservoir could provide additional yield and or serve as regulating storage for water being transferred westward to areas of need in the central part of the state.". I can easily see Toledo Bend water going to Austin and San Antonio as well as Houston. This is not living within our means and is disrupting entire multiple watersheds in a third of the State of Texas. This is not a comforting thought for a plan that is supposed to care about the environment. This same phrase is also given on page 1 - 1 of the companion report. "Operation Studies and Opinions of Cost for Allens Creek Reservoir, Volume I - Text.

8) I am very concerned about the water transfer proposal on page 6 that will take Trinity River (Luce Bayou Project) across Sam Houston National Forest in San Jacinto County. We must stop thinking of the NF as a place to put projects across and destroy the environment. I am also concerend about the canal that is shown as connecting Lake Conroe to the Conroe Area. It appears as if the San Jacinto River may be impacted by this. The river makes an excellent flood control, recreation, and wildlife corridor to Lake Houston and should be protected and not degraded.

9) Many of the other dams on page 6 look unneeded including the Paluxy Dam. Rio Grande Wier, and others.

10) I have a concern that this plan does not do enough about stressing the need to learn to live with droughts and not fight against them. Droughts are not disasters. People living where there is not enough water is the disaster. It is natural and cyclical to have dry and wet times. We need to adapt to these real natural rhythms and not try to engineer our way around them.

11) The State must stop granting water rights permits to already overallocated waters. This makes no sense at all. In addition the state must not do anything to weaken the Texas Open Records or Meetings Acts. There are very few real emergencies that require such draconian authority that cannot be seen coming and planned for ahead of time. Do not wait for droughts or floods but plan ahead. I am totally against any emergency suspension of inflows into bays, estuaries, and rivers. You do not even define what emergency is here or give the criteria for determining if it exists.

12) I am not for using streams as conveyance mechanisms for someone's water that will be used later. Once the water hits the stream it is the public's and should be used for public purposes. Also on page 11, TNRCC "must" and not simply "consider" mitigate impacts of interbasin transfers. Why would you allow short-changing of other's environment when you take their water?

13) Once again water conservation is given short shrift here. A minimum water conservation plan must reduce use by 30%. Otherwise you are just paying lipservice to what we can do to save water.

14) On page 13, I am against streamlining water rights permitting. This usually means the public has fewer opportunities to get their concerns on record. Also on page 15. I do not want the state to buy dam sites. Buying dam sites ensure that boondoggle projects will be provided subsidies and momentum for completion.

15) On page 16. I do not see a crisis of bond funding. It looks like alot of money is left to use. It is obvious the State wants to mix all the monies so it can use them to build boondoggle water projects without the public's oversight. I object. In addition environmental mitigation must be a state requirement and not just a federal one.

16) On page 19 flooded areas should be bought and turned into natural flood control areas and be used for parks, recreation, and wildlife corridors.

17) On page 23. I have real concerns about regional environmental mitigation banks. These banks, if not operated properly, may make development of wetlands sites, which under Section 404(b)(1) guidelines by the U. S. EPA are deemed to be sites of special significance and should not be developed, easier to develop. Two areas where mitigation banks would be useful would be the Katy Prairie, so that we could create at least a 50,000 acre Katy Prairie National Wildlife Refuge, and Sam Houston National Forest where we could buy inholdings, acquire buffer lands, and corridors to connect all of the federal forest lands.

18) I see nothing in here that addresses saving wild, scenic, and recreational rivers in our state. This is a large oversight and must be corrected.

19) In west Harris County and in Waller and Fort Bend Counties I want to see some groundwater use saved for the Katy Prairie and the farms that exist there so the hundreds of thousands of waterfowl and shorebirds can safely live in this area.

20) I am against golf course irrigation projects having a greater priority than instream flows for wildlife and for natural purposes.

21) I am very concerned that the present studies on inflows into Galveston Bay suggest that about half of the water (4.9 million acre feet) be protected for bays and estuaries and the other 50% be allowed to be sucked up by development. This hardly seems fair to the environment and its natural range of flows.

Because of these concerns I request that this document be withdrawn and not be developed until the new Texas Water Plan is finalized. Thank you.

Sincerely,

Brandt Mannchen

Brandt Mannchen
1705 Michigan #3
Houston, Texas 77006
H713-521-9534, W713-640-4313

BRT94138-2.10

COUNTY JUDGE
Fort Bend County, Texas

Michael D. Rozell
County Judge

(713) 341-8608
Fax (713) 341-8609

AG

January 16, 1997

Copy To Jeff Taylor
And Tom Gooch ✓

Mr. Albert Gray
Coordinator, Trans-Texas Water Program Southeast Area
Sabine River Authority
P. O. Box 579
Orange, Texas 77630

Dear Mr. Gray:

I understand that the Trans-Texas Water Program (Southeast Study Area) is considering the proposed Allens Creek Reservoir as a water supply option for meeting projected water demand in the State of Texas. As a local official, I am in favor of the Allens Creek Reservoir because:

- Fort Bend County will ultimately need a dependable surface water supply

- future economic development in Fort Bend County depends on the future availability of a dependable water supply

- the reservoir can store otherwise destructive flood water for constructive use during droughts

- the reservoir will have a positive economic impact on Fort Bend County due to increased recreational facilities and tourism

- the reserve will have a positive impact on Fort Bend County due to the potential for development and increased property value of the land surrounding the reservoir

- the reservoir will enhance the environment by replacing flood prone agricultural and grazing land with a reservoir that can support a large fish and bird population.

I urge you to give full consideration to the positive economic impact that the Allens Creek Reservoir will have on the local and regional economy and recommend it as a water supply project to the State.

Sincerely,

Michael D. Rozell
County Judge

MDR/lz

BRT94138-2.10

AG

MISSOURI CITY 1522 TEXAS PARKWAY • P.O. BOX 666 • MISSOURI CITY, TEXAS 77459 • 281-261-4260

MAYOR
Allen Owen

January 21, 1997

Copy To Jeff Taylor and Tom Gooch ✓

Mr. Albert Gray
Coordinator, Trans-Texas Water Program Southeast Area
Sabine River Authority
P. O. Box 579
Orange, Texas 77630

Re: Proposed Allens Creek Reservoir

Dear Mr. Gray:

I understand that the Trans-Texas Water Program (Southeast Study Area) is considering the proposed Allens Creek Reservoir as a water supply option for meeting projected water demand in the State of Texas. As a local official, I am in favor of the Allens Creek Reservoir because:

- The City of Missouri City will ultimately need a dependable surface water supply.
- Future economic development in the City of Missouri City depends on the future availability of a dependable water supply.
- The reservoir can store otherwise destructive flood water for constructive use during droughts.
- The reservoir will have a positive economic impact on the City of Missouri City due to increased recreation facilities and tourism.
- The reservoir will have a positive economic impact on the City of Missouri City due to the potential for development and increased property value of the land surrounding the reservoir.
- The reservoir will enhance the environment by replacing flood prone agricultural and grazing land with a reservoir that can support a large fish and bird population.

I urge you to give full consideration to the positive economic impact that the Allens Creek Reservoir will have on the local and regional economy and recommend it as a water supply project to the State.

Sincerely,

Allen Owen
Mayor

cc: Mike D. Rozell
Fort Bend County Judge

Herb Appel
Greater Fort Bend Economic Development

Brazos River Authority

BRT94138-2.10

Raymond R. Betz Interests, Inc.
Raymond R. Betz Brokerage, Inc.

The BETZ Companies
Established in 1976

Betz Realty Investors, L.C.
Betz Realty Management, L.C.

AG

January 17, 1997

Copy To Jeff Taylor And Tom Gooch.

Mr. Albert Gray
Coordinator, Trans-Texas Water Program Southeast Area
SABINE RIVER AUTHORITY
P.O. Box 579
Orange, Texas 77630

RE: Proposed Allens Creek Reservoir

Dear Mr. Gray:

I understand that the Trans-Texas Water Program (Southeast Study Area) is considering the proposed Allens Creek Reservoir as a water supply option for meeting projected water demand in the State of Texas. As a local real estate professional, I am in favor of the Allens Creek Reservoir because:

- Fort Bend County will ultimately need a dependable surface water supply.
- future economic development in Fort Bend County depends on the future availability of a dependable water supply.
- the reservoir can store otherwise destructive flood water for constructive use during droughts.
- the reservoir will have a positive impact on Fort Bend County due to:
    - increased recreation facilities and tourism.
    - the potential for development and increased property value of the land surrounding the reservoir.
- the reservoir will enhance the environment by replacing flood prone agricultural and grazing land with a reservoir that can support a large fish and bird population.

I urge you to give full consideration to the positive economic impact that the Allens Creek Reservoir will have on the local and regional economy and recommend it as a water supply project to the State.

Sincerely,

RAYMOND R. BETZ BROKERAGE, INC.

Tom Condon, Jr.
Vice President

cc: The Greater Fort Bend Economic Development Council

BRT 94138-2.10

Raymond R. Betz Interests, Inc.
Raymond R. Betz Brokerage, Inc.

The BETZ Companies
Established in 1976

Betz Realty Investors, L.C.
Betz Realty Management, L.C.

AG

January 27, 1997

Copy To Jeff Taylor + Tom Gooch ✓

Mr. Albert Gray
Coordinator, Trans-Texas Water Program Southeast Area
SABINE RIVER AUTHORITY
P.O. Box 579
Orange, Texas 77630

RE: Proposed Allens Creek Reservoir

Dear Mr. Gray:

I understand that the Trans-Texas Water Program (Southeast Study Area) is considering the proposed Allens Creek Reservoir as a water supply option for meeting projected water demand in the State of Texas. As a local real estate professional, I am in favor of the Allens Creek Reservoir because:

- Fort Bend County will ultimately need a dependable surface water supply.
- future economic development in Fort Bend County depends on the future availability of a dependable water supply.
- the reservoir can store otherwise destructive flood water for constructive use during droughts.
- the reservoir will have a positive impact on Fort Bend County due to:
    - increased recreation facilities and tourism.
    - the potential for development and increased property value of the land surrounding the reservoir.
- the reservoir will enhance the environment by replacing flood prone agricultural and grazing land with a reservoir that can support a large fish and bird population.

I urge you to give full consideration to the positive economic impact that the Allens Creek Reservoir will have on the local and regional economy and recommend it as a water supply project to the State.

Sincerely,

Raymond R. Betz

cc: The Greater Fort Bend Economic Development Council

Response to Comments by **Frederick Werner, US Fish and Wildlife Service:**

First four paragraphs: Noted.

Fifth paragraph: The Trans-Texas Scope called for a review of the benefits and environmental impacts of operating Allens Creek Reservoir as a balancing reservoir in the Trans-Texas system. The environmental impacts of using Allens Creek as a balancing reservoir are very similar to those of using it as a water supply project. Those effects are covered in the report. The use of Allens Creek operationally as a balancing reservoir would cause day to day variations but would not impact the yield. However, if considerable storage is dedicated to smoothing out *seasonal* demand, this would affect the yield. The specifics of the balancing reservoir operation would depend on the specifics of the program to export water to the west. The trade-off between yield and the balancing need should be analyzed at the time a specific program of transfer is established.

Response to Comments by **Brandt Mannchen:**

Item #7 referencing Allens Creek Reservoir: Noted

Response to Comments by **Don Hooper, Fort Bend ISD: Noted**

Response to Comments by **Jim McDonald, City of Meadows: Noted**

Response to Comments by **Michael Rozell, Fort Bend County Judge: Noted**

Response to Comments by **Allen Owen, Mayor of Missouri City, Texas: Noted**

Response to Comments by **Tom Condon, The Betz Companies: Noted**

RESPONSE TO COMMENTS

Response to Comments by Edward Feith, Houston Lighting and Power Company:

1. Treatment of the Potential Alignment Change
   This report covers several specific work tasks related to simulation of reservoir performance and a revised estimate of probable project cost, all of which are based on the project concept that has been proposed since at least 1974. The possibility that the environmental impact of the project could be significantly improved by realignment of the embankment and raising the storage level three feet without loss of performance or increase in total cost was recognized and explored after those other tasks were completed. Preliminary evaluations confirmed that the change would be basically beneficial, as shown in Table 6-1 of the report. We think the sequence in which these findings are covered is valid and that it is more realistic to present the alignment change as an option than to take it for granted at this time. It is not a fundamental change, but rather a refinement at the detail level. We believe the report deals with it in a proper manner.

2. Impact on the Local Economy
   This is more an environmental factor than something to be covered in the operation study report. We are adding discussion of this consideration in Section 4 of the environmental report.

3. Operation as Part of the Brazos River Authority System
   The scope of work for the Trans-Texas studies refers to the Allens Creek project in the context of "a balancing reservoir in the Trans-Texas system." Its function as a component of the Trans-Texas program might or might not contribute directly to the Authority's system performance. Obviously, the Trans-Texas system as a whole would need to operate in a way that would be compatible with the BRA system, but it remains to be seen whether it would be closely coordinated with that system. As you know, this is a complex issue, and it was not included among the tasks budgeted for the present report.

Response to Comments by Brandt Mannchen:

Item #7 referencing Allens Creek Reservoir: Noted

Response to Comments by Frederick Werner, U.S. Fish & Wildlife Service:

First four paragraphs: Noted.

Fifth paragraph: The Trans-Texas Scope called for a review of the benefits and environmental impacts of operating Allens Creek Reservoir as a balancing reservoir in the Trans-Texas system. The environmental impacts of using Allens Creek as a balancing reservoir are very similar to those of using it as a water supply project. Those effects are

covered in the report. The use of Allens Creek operationally as a balancing reservoir would cause day to day variations but would not impact the yield. However, if considerable storage is dedicated to smoothing out *seasonal* demand, this would affect the yield. The specifics of the balancing reservoir operation would depend on the specifics of the program to export water to the west. The trade-off between yield and the balancing need should be analyzed at the time a specific program of transfer is established.

Response to Comments by **Don Hooper, Fort Bend ISD: Noted**

Response to Comments by **Jim McDonald, City of Meadows: Noted**

Response to Comments by **Michael Rozell, Fort Bend County Judge: Noted**

Response to Comments by **Allen Owen, Mayor of Missouri City, Texas: Noted**

Response to Comments by **Tom Condon, The Betz Companies: Noted**

Neches Salt Water Barrier
Environmental Analysis

March 18, 1998

Mr. Tom Gooch
Freese & Nichols
4055 International Plaza, Suite 200
Fort Worth, Texas 76109

Re: Texas Water Development Board (Board staff) Comments on Trans-Texas Water Program "Environmental Analysis for the Neches Salt Water Barrier, Beaumont, Texas", February 1998

Dear Mr. Gooch:

Board staff has reviewed the above-referenced report and offer the following comments in Attachment 1.

The Board looks forward to receiving one (1) unbound camera-ready original and nine (9) bound double-sided copies of the Final Report on this planning project. Please contact Mr. Gordon Thorn, Director, Research and Planning Funds Management Division, at (512) 463-7979, if you have any questions about the Board's comments.

Sincerely,

Tommy Knowles

Tommy Knowles
Deputy Executive Administrator
for Planning

ATTACHMENT 1

TEXAS WATER DEVELOPMENT BOARD

COMMENTS ON TRANS-TEXAS WATER PROGRAM
"ENVIRONMENTAL ANALYSIS FOR THE NECHES SALT WATER BARRIER, BEAUMONT, TEXAS"

- The description of riparian wetlands on the lower Neches River occurs in section "3.3.5 Wetlands" on pages 4-6. According to the report, "much of this floodplain supports forested and emergent wetlands, including bald cypress-tupelo swamp, bottomland hardwood forest, and fresh water marsh habitats." There is no reference to document the occurrence of these wetlands types and vegetation. If wetland ecologists from Freeze & Nichols, Inc. (F&N) actually delineated the site, please provide this documentation.

- To the contrary, our predecessor agency's Report 268, entitled "Erosion and Sedimentation by Water in Texas," published by the Texas Department of Water Resources in 1982, classifies this area as "Western Gulf Coastal Flatwoods." About 87% of the area is in forest land, principally pine and pine-hardwood. There is no bottomland hardwoods in the proposed project area according to this report. The Soil Conservation Service's "Land-Resource Map" for Texas (SCS 1979), also delineates the proposed project area as Western Gulf Coastal Flatwoods, rather than the Bottomland Hardwood Forest described by F&N.

- The description of Bottomland Hardwood Forest on page 3-6 of the draft report, falls within the section describing "Wetlands." However, there is confusion between the terminology used by Texas Parks & Wildlife Department that refers to a forest type by the name of Bottomland Hardwood Forest, and the U.S. Fish & Wildlife Service's wetland type, also called a Bottomland Hardwood Forest. The description in this draft report contains a combination of both definitions, with reference to loblolly pine occurrence in mesic sites (i.e., the mid-range moisture bearing areas), and bald cypress in the hydric areas (i.e., very moist or wet areas). The only hardwoods F&N describes for the area is in the "upland oak-pine forest" system, which is above the floodplain in the mesic areas. The use of Bottomland Hardwood Forest needs to be described and defined

- The draft report provides information on the potential occurrence of endangered and threatened species, however, it does not report on any field reconnaissance that was required in the SOS for this study. According to the report, the Texas Biological and Conservation Data System maintained by the TPWD was used to identify any possible occurrences. While this is an

important step, it is not in full compliance with the SOS. In order to be comprehensive, F&N should have reviewed current listings of the TPWD, USFWS, and TOES. There were no references to any list, nor were any references provided to any lists used in this assessment. The reader therefore cannot determine if the 12 species referred to is current and comprehensive for all the state, federal, and TOES listed species. Please provide information and references based on all of these lists.

- All other aspects of the draft report dealing with aquatic and terrestrial habitat, recreation, wetlands (other than Bottomland Hardwood Forest), the Big Thicket National Preserve, mitigation, and other factors appears to be well assessed and reported herein.

BRT94138

United States Department of the Interior

NATIONAL PARK SERVICE
Big Thicket National Preserve
3785 Milam
Beaumont, Texas 77701

IN REPLY REFER TO:
L54(BITH)
xL2415(BITH)

March 31, 1998

Ms. Barbara Nickerson
Freese & Nichols
4055 International Plaza, Suite 200
Fort Worth, TX 76109

Subject: Neches Salt Water Barrier Environmental Report Dated February 1998

Dear Ms. Nickerson:

I would like to take the opportunity to comment on the subject Environmental Report. Over the years, as pointed out in Section 1.0, the Lower Neches Valley Authority (LNVA) has historically erected temporary salt water barriers at various locations along both the Neches River and Pine Island Bayou. I believe that in every instance of this construction, these barriers were erected within the boundary of the Big Thicket National Preserve. This construction has come at a cost to the integrity of the natural resources for which the National Park Service (NPS) has a mandate to preserve and protect.

Over the years, ***the NPS has gone on record numerous times supporting the construction of a permanent salt water barrier conditioned that the permanent barrier be located downstream of the preserve, completely outside the boundary of the preserve.*** In reading the subject document, and from information I have received through numerous conversations with the U.S. Army Corps of Engineers and the LNVA, it is clearly my understanding that the proposed construction of the permanent barrier meets this condition. Therefore, although Figure 1.2, the Site 6 Plan included in the subject report, which continues to graphically represent some portion of the barrier and/or its appurtenant works located within the preserve boundary, I hereby again go on record stating that it is my understanding that the construction

of a permanent salt water barrier shall be located downstream of the preserve, completely outside the boundary of the preserve; and, if this is true, again express National Park Service support for this project.

Thank you for this opportunity to comment on this report.

Sincerely,

Richard R. Peterson,
Superintendent

cc: Frederick T. Werner
Chief, Regulatory Activities
U.S. Fish and Wildlife Service
17629 El Camino Real, Suite 211
Houston, TX 77058

Commander - Galveston Dist.
US Army, Corps of Engineers
P.O. Box 1229
Galveston TX 77553-1229

Terry Roberts (CESSWG-PL-R)
US Army, Corps of Engineers
Galveston District
P. O. Box 1229
Galveston, TX 77553-1229

ADK
TC G

TEXAS PARKS & WILDLIFE

March 30, 1998

Ms. Barbara Nickerson.
Freese & Nichols
4055 International Plaza, Suite 200
Fort Worth, Texas 76109

Re: Environmental Analysis for the Neches Salt Water Barrier - Beaumont, Texas.

Dear Ms. Nickerson:

Staff of the Texas Parks and Wildlife Department have received and reviewed the above referenced report and have comments to offer (attached).

It has been a pleasure working with you and the other South East Trans- Texas participants. The amount of time, energy and patience invested in this process will have been worthwhile as we move forward in the regional planning process. We look forward to continuing our work with the Region H and I Planning Groups to identify the most cost-effective and environmentally sensitive water management strategies to ensure safe, adequate water for all Texans.

If you have any questions, please contact Woody Woodrow, Upper Coast Team Leader, at (281) 461-4071.

Sincerely,

C L Loeffler

Cindy Loeffler, P.E.
Water Resources Team Leader
Resource Protection Division

CLL:JOW

attachments

To manage and conserve the natural and cultural resources of Texas for the use and enjoyment of present and future generations.

4200 SMITH SCHOOL ROAD
AUSTIN, TEXAS 78744-3291
512-389-4800
www.tpwd.state.tx.us

Environmental Analysis for the Neches Salt Water Barrier - Beaumont, Texas.

1.0 Introduction

It would be worthwhile to present information on the amount of water (and cost of that water) that must be released from B. A. Steinhagen to provide 2,500 cfs flow at Pine Island Slough to counteract the saltwater wedge during low flow periods. This information would be useful for comparing the cost of the increased flow alternative to the cost of the salt water barrier construction. Senate Bill 1 Regional water planning guidelines state that regional plans shall consider a balance of economic, social, aesthetic, and ecological viability and that freshwater inflow needs to estuaries shall be considered.

2.0 Other Alternatives

Why were the no action, or increased flows alternatives not considered in Chapter 2?

3.3.3 Instream Flows

Although the TTWP environmental criteria were applied by Freese and Nichols in a 1994 study, it appears that the more recently developed Consensus-Based Water Plan (CWP) Environmental Planning Criteria (EPC) have not been applied. The main difference between the TTWP environmental criteria and the EPC is that the EPC act to balance water shortages since environmental pass throughs are reduced as climate conditions become drier. Senate Bill 1 Regional Water Planning groups must use the EPC in cases where site-specific information (i.e. bay and estuary or instream flow studies) have not been completed. Since the barrier restricts the flow of freshwater during drought periods to the Sabine Lake Estuary, consideration should be given to passing sufficient flows to protect this economically important resource.

4.3.3 Wetlands

While there will be a decrease in salinity upstream of the barrier it is unclear at the current time if the salinities at the surface of the water are high enough to cause stress on the cypress-tupelo vegetation complex above Location 6. Without the barrier in place and during low flow periods, the water level above Location 6 will drop significantly. Most of the swamp forest should be above the water level. These low water levels are important because cypress and tupelo seeds require exposed substrate to germinate. We would be interested in any salinity data collected above Location 6 in the near surface water column during low flow periods. These data would support the contention that increased salinities occur within the wooded swamps and that these salinities are high enough to cause stress and reduce productivity. If salinities are causing stress, benefits to riparian and wetland areas should not be lost by a reduction in tree requitement caused by backwater effects. There is no discussion of the effects that increased salinities below the barrier will have on the cypress-tupelo forest present below the barrier during low flows. The impacts to these forested wetlands and riparian zones should also be considered.

4.4.2 Threatened and Endangered Species

It is unclear what impact this project will have on threatened and endangered species, especially to paddlefish. Although the barrier is expected to lower salinity upstream, it will also create increased salinities downstream. TPWD should be consulted to discuss potential impacts to paddlefish including due to stranding below the barrier.

4.4.3 Fisheries

Again emphasis is placed on increased ecosystem productivity resulting from a reduction in salinity. This statement implies that there is currently an inhibition on ecosystem productivity because of increased salinities. A similar statement implies there will be improved fisheries because of the project. Where is the data to support these claims?

4.4.4 Big Thicket Preserve

The discussion on backwater effects should be elaborated on to define how much backwater effect will be incurred, explanation of what the natural flow regime is, and how the water quality of riparian areas will be improved.

to: Barbara Nickerson, Freese and Nichols

from: Saul Aronow, member TAC, Beaumont, Texas;
phone (409)-892-9141)

concerning: Neches Salt-Water Barrier report

1. Cultural survey has been completed and exists in a draft form; survey done by Espey-Huston; contact Tommy Hebert of LNVA (who paid for the study) or Caroline Murphey, Corps of Engineers, Galveston.

2. page 3-1--ref to "Beaumont Clay Formation" and "Beaumont Clay" improper geologic usage. Should read "Beaumont Formation."

3. page 3-1--ref to Flawn, 1968 superseded by

Barnes, V. E., editor, 1992, Geologic atlas of Texas, Beaumont sheet. Bureau of Economic Geology, The University of Texas at Austin, Austin, Texas.

4. page 3-1--depth to Chicot and Evangeline aquifers at site of proposed barrier can be approximated by looking at x-sections in several Texas Water Development Board ground-water studies prior to Thorkildsen and Quincy (1990) which are probably in your company library. Let me know if refs needed.

RESPONSE TO COMMENTS

Response to comments by Saul Aronow, member TAC, Beaumont, Texas:

3.5 A discussion of the cultural resources survey report by Espey, Houston, & Associates, Inc. was included in Section 3.5.

3.1 Text was revised.

Response to comments by the United States Department of the Interior:

No revisions necessary.

Response to comments by the Texas Parks and Wildlife Department:

1.0 Additional text was incorporated. Details of project cost estimates are also located in Section 5.

2.0 Due to the scope of this report, the only alternative to be investigated is a navigation lock near Sabine Lake. This discussion is located in Chapter 2D.

4.3.2 Improvement of water quality is discussed and supported with references. 4.4.1A supporting reference was added.

4.4.2 Text was modified based on updated lists. Section 4.4.2 emphasizes the need for consultation with TPWD regarding potential impacts to paddlefish, upon approval of a site plan for the saltwater barrier.

4.4.3 A supporting reference was added.

4.4.4 Additional text was incorporated.

Response to comments by the Texas Water Development Board

3.3.5 Supporting references were added. The description of Bottomland Hardwood Forest on page 3-6 falls within the section describing "Natural Communities" not "Wetlands."

3.4.2 Updated threatened and endangered species lists were obtained for verification.

Environmental Analysis for Potential Transfer Routes

TEXAS WATER DEVELOPMENT BOARD

April 15, 1998

Mr. Sam Collins
Executive Vice President
Sabine River Authority
P. O. Box 579
Orange, Texas 77632

Re: Texas Water Development Board (Board staff) Comments on Trans-Texas Water Program "Environmental Analysis for Potential Transfer Routes", February 1998

Dear Mr. Collins:

Board staff has reviewed the above-referenced report using the revised scope of work and have no comments.

The Board looks forward to receiving one (1) unbound camera-ready original and nine (9) bound double-sided copies of the Final Report on this planning project. Please contact Mr. Gordon Thorn, Director, Research and Planning Funds Management Division, at (512) 463-7979, if you have any questions about the Board's comments.

Sincerely,

Tommy Knowles
Deputy Executive Administrator
for Planning

General Comments

3/31/98
To: MEMBERS, SOUTHEAST POLICY MANAGEMENT COMMITTEE, AND
TECHNICAL ADVISORY COMMITTEE TRANS-TEXAS WATER PROGRAM
Re: WATER CONSERVATION REPORT DRAFT
Patty Neild
1256 Moore Road
Beaumont, Texas 77713
Member Board of Director's Lower Neches Valley Authority

For every gallon of water inventoried and projected in this study, there is ten times that amount falling on Texas annually. A great deal of space and emphasis was given to smaller toilets and the impact they have on usage in the Houston metropolitan area. Also, great concern for washing and watering practices was highlighted as an indication that Houston is doing everything humanly possible to conserve the water in their basin. The basic premise assumed in the study is that as this water is exhausted interbasin transfer is the preferred long term solution to the needs of the Houston metropolitan area.

This study gave little effort to projecting the amount of water that could be collected annually from rainfall. This water is currently a lost asset of the State and a liability for many flood prone areas of Southeast Texas. The interbasin transfer option presumes that it is cheaper to trench and pump than to build reservoirs.

I guess the question is cheaper for whom. In the short shift some interbasin transfers might be necessary through existing canal systems but the long term best interest of both Houston and Southeast Texas is not served by a system of canals for interbasin transfers. In the long run such a system will leave everyone in need of water.

It seems to me that we are all best served by collecting the ever renewable asset rain in a series of reservoirs. These reservoirs may seem expensive now but in 50 years they will be a cheap investment in harnessing the water that currently runs to the Gulf often leaving behind destruction.

April 14, 1998

Ms. Patty Neild
1256 Moore Road
Beaumont, TX 77713

Regarding: Trans-Texas Water Program

Dear Ms. Neild,

The project team has reviewed your comments on the Trans-Texas Water Program. As discussed at the joint Policy Management and Technical Advisory Committees' meeting held March 31, 1998 in Beaumont Texas, the TTWP has investigated many alternative techniques for meeting the future water needs of the Southeast Area. Your comments are thoughtful ones that have been considered by water planners for many years. However, creating additional water supply through the construction of many new surface water storage facilities is considered unlikely due to the significant difficulties associated with securing suitable reservoir sites and acquiring the necessary permitting in our current regulatory environment.

The water industry has significantly matured and new reservoir construction is not now the preferred option for new water supplies. It is now more cost effective and less environmental impacting to perform interbasin transfers than to build new reservoirs.

Thank you for your comments and the careful consideration you have given the TTWP .

Sincerely,

Jeff Taylor
Project Manager

April 13, 1998

TRANS TEXAS WATER PROGRAM
Brown & Root
P.O. Box 3
Houston, TX 77001-0003

To Whom It May Concern,

We are in the rice farming business in the Beaumont area. We also raise crawfish and sod, which also requires three to four acre feet of water a year. I have some concerns about sending water from this area to other areas of the state. My family and I have invested heavily in this area because of the ample water supply.

I feel if people want our water they should move here. If we had extra water I would not see a problem sending some to other areas, but last year during the drought we were nearly cut off of water for our crops, this really concerns me... with land notes, equipment notes, labor , etc. We CAN NOT afford to be without water.

Our operation is also expanding on a yearly basis. We are getting bigger in Organic rice, for instance we started out contracting two hundred acres four years ago, where today we are contracting with area farmers approximately thirteen hundred acres. Our sod operation is also expanding from currently one hundred eighty acres to two hundred eighty acres by next year. Our crawfish operation is going form six hundred acres this year to seven hundred fifty acres for next year.

I do not see a reduction in acres like what we have seen in the past. I feel like agriculture is here to stay with genetic engineering and biotechnology we are definetly an industry of the future. I have always said if we think foreign countries have us were they want us now because of oil imports I would hate to see what they would do to us if we depended on them for our food supply.

I also have a son that is planning to attend college to get a degree in agriculture and come back to the farm to take over the operation one day, so all I'm trying to get across is that agriculture in our area is not a thing of the past but a busiess with a very bright future.

Thanks,

Mike D. Doguet

April 14, 1998

Mr. Mike Doguet
795 S. Major Drive
Beaumont, TX 77707

Regarding: Trans-Texas Water Program Comment

Dear Mr. Doguet,

The project team has reviewed your comments on the Trans-Texas Water Program. Under separate cover, I have forwarded a copy of your letter to the Texas Water Development Board, with a request to study in more detail projected Southeast Texas agricultural growth trends. I urge you to use the Texas Farm Bureau and other organizations to convey your message regarding the health of your industry. As stated at the March 31, 1998 meeting in Beaumont, existing water supplies will be considered as excess available supplies if current levels of use significantly decline. You can expect that if agricultural interests can not demonstrate a need for those supplies, municipal interests will consider acquisition of that water. Good luck in your business, if there is anything I can help you with, please call.

Thank you for your comments and the careful consideration you have given the TTWP.

Sincerely,

Jeff Taylor
Project Manager

BILL DISHMAN JR.

5730 GLASGOW

BEAUMONT, TEXAS 77706

COMMENTS FOR TRANS TEXAS WATER HEARING RECORD

April 12, 1998

These comments are in support of maintaining the water available to the agricultural community at current levels, rather than the proposed decrease projected through the year 2050. I am a fourth generation farmer from Beaumont, Texas. I serve on several state and national rice research, promotional and legislative boards for the Texas rice industry. Agriculture has been a thriving industry in Southeast Texas for over 100 years. Rice farming, crawfish and aquaculture production, cattle ranching and horticultural crops have and will continue to pump millions of dollars into the local economy. The success of agriculture in Southeast Texas is due to the abundance and availibility of reasonably priced water and farm land in the area. In addition to the impact farming has on the economy, we provide the habitat necessary for migrating ducks, geese and other shore birds to winter over in. We purify the water and releases from rice fields downstream establishes the eco-systems to support fragile plant and animal life in wetlands, bays and estuaries throughout the Gulf Coast region.

The report is projecting a decrease in acreage devoted to agricultural use. While past trends might support this, we in the agricultural industry feel that trend is stopping. In fact, there is potential for growth in our industry over the next few years. With bio-technology now becoming a factor in agriculture, we can overcome some of the major limiting factors in rice farming such as red rice and extended cropping rotations. We have shifted to a market oriented farm program which also adds stability to our overall financial outlook. There is tremendous opportunity to expand our aquaculture industry in the area. Ever increasing regulation on commercial shrimpers and fishermen make farming of fish and crawfish very attractive to area farmers.

In conclusion, it goes without saying that if you take away the water, then you take away agriculture in Southeast Texas. Every type of farming in this area is dependent on a dependable supply of irrigation water. Less than two years

ago, there was a severe drought that drained our dams down to unprecedented levels. By state law, rice farmers came within inches of losing our water for rice production that year. If water basin transfers were in progress at that time, then rice farmers would not have had water that year and our industry would have collapsed.

Respectfully Submitted,

Bill Dishman Jr.

Bill Dishman Jr.

April 14, 1998

Mr. Bill Dishman, Jr.
5730 Glasgow
Beaumont, TX 77706

Regarding: Trans-Texas Water Program Comment

Dear Mr. Dishman,

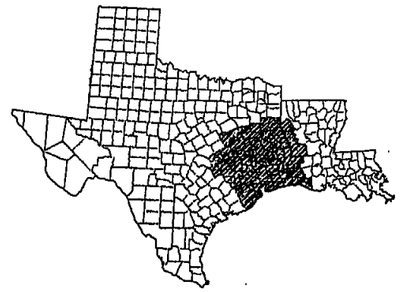
The project team has reviewed your comments on the Trans-Texas Water Program. Under separate cover, I have forwarded a copy of your letter to the Texas Water Development Board, with a request to study in more detail projected Southeast Texas agricultural growth trends. I urge you to use the Texas Farm Bureau and other organizations to convey your message regarding the health of your industry. As stated at the March 31, 1998 meeting in Beaumont, existing water supplies will be considered as excess available supplies if current levels of use significantly decline. You can expect that if agricultural interests can not demonstrate a need for those supplies, municipal interests will consider acquisition of that water. Good luck in your business, if there is anything I can help you with, please call.

Thank you for your comments and the careful consideration you have given the TTWP.

Sincerely,

Jeff Taylor
Project Manager

TEXAS



LOCATION MAP

LOUISIANA

GULF OF MEXICO

HOUSTON

APPROXIMATE SCALE IN MILES
SCALE 1:1,584,000

LEGEND

- CITY
- MAJOR RIVER
- STREAM
- RESERVOIR
- COUNTY OR PARISH LINES
- STATE LINE
- STUDY BOUNDARY
- FEDERAL LANDS *
- BIG THICKET NATIONAL PRESERVE
- NEW CONVEYANCE FACILITY
- EXISTING CONVEYANCE FACILITY
- FLOW PATH VIA EXISTING STREAMS OR LAKES
- ROUTE SEGMENT (FLOWS FROM EAST TO WEST)

* National Forest Boundaries are approximate. Inclusions of private land within the National Forests are not shown.

SOUTHEAST STUDY AREA ALTERNATE SEGMENTS

FIGURE 3.4