

# Appendix

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# Appendix A

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## 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, limnologic 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 69<sup>th</sup> 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	First Name	Last Name	Representing
Alan	Allen	Sportsmen Conservationists of Texas	Jerry	McCroy	U. S. Army Corps of Engineers: Ft. Worth
Larry	Armentor	Devers Canal Rice Producers, Inc.	John	McDonald	Orange County
Dede	Armentrout	National Audubon Society	Ned	Meister	Texas Farm Bureau
Saul	Aronow	Golden Triangle Sierra Club	Gordon	Meyers	Gulf Coast Water Authority
Lary	Banner	Citizen	Bill	Moore	San Jacinto River Authority
Barbara	Barron	League Women Voters of Texas	Gary	Neighbors	Angelina & Neches River Authority
Ragina	Bell	Citizen	Ronald	Neighbors	Harris Galveston Coastal Subsidence Dist.
Tony	Bennett	Citizen	Oscar	Nelson	Chambers County
David	Berkshire	Big Thicket Conservation Association	Fred	Ore	U. S. Bureau of Reclamation
Janice	Bezanson	Texas Committee on Natural Resources	Rafael	Ortega	Harris County
Carolyn	Bilski	Austin County	Catherine	Perrine	League Women Voters of Texas
Bob	Bowman	Deep East Texas Development Assc.	John	Phillips	Citizen
Philip	Bowman	La. Dept. Wildlife & Fisheries	Glenn	Phillips	Sabine River Authority
Don	Braddock	Citizen	J.	Prestidge	Senator Carlos Truan's Office
Joe	Broadus	U.S. Geological Survey	Ronnie	Raum	U.S. Forest Service
J.	Brown	Jardin County	Linda	Rhodes	Citizens Environmental Coalition
Marilyn	Browning	Galveston Bay National Estuary Program	Lance	Robinson	Texas Parks and Wildlife Department
Tom	Calnan	Coastal Coordination Council	Ralph	Rundle	Coastal Water Authority
Jimmie	Cokinos	Pct.1 Jefferson Co.	Todd	Running	Citizen
Dave	Cowen	US Forsest Service	David	Rusk	Citizen
Marty	Craig	GLO Coastal Liaison	Jane	Saginaw	US EPA
Paul	Crutchfield	Chambers-Liberty Counties Navigation District	Harold	Schild	Vidor
Kevin	Daniels	Gulf Coast Conservation Assoc.	Cynthia	Schmidt	Houston Lighting & Power
Richard	Diehl	Association of Water Board Directors	Lon	Sharver	Newton County
Robert	Eckels	Harris County	Linda	Shed	Galveston Bay Foundation
Richard	Fernandez	City of Houston	Frank	Shipley	Galveston Bay National Estuary Program
Michael	Foster	South East Texas Regional Planning	Bruce	Sieve	Golden Triangle Sierra Club
Frances	Gelwick	Texas A&M University	Larry	Soward	Texas Department of Agriculture
Albert	Green	Texas Parks and Wildlife Department	Art	Spencer	Lower Neches Valley Authority
Terry	Greer	Toledo Lake Assc.	Terry	Stelly	Concerned Citizen
Carl	Griffith	Jefferson County	James	Stewart	Houston Audubon Society
Mike	Harbordt	Harris County Manufacturing Assc.	Jim	Stokes	Beaumont Chamber of Commerce
Richard	Harrel	Clean Air & Water Inc.	Rick	Strahan	Big Thicket National Preserve
Duane	Hengst	Citizen	Wayne	Stupka	Coalition Advocating a Safe Environment
John	Hyden	Sabine County	Rusty	Swafford	National Marine Fisheries Service
Bill	Jackson	National Marine Fisheries Service	Melvin	Swoboda	Sabine River Authority
Maxine	Johnson	Big Thicket Conservation Assn.	Edward	Tadlock	City of Houston
John	Johnson	Jefferson County Judge	Jack	Tatum	Sabine River Authority
Jim	Kachtick	Greater Houston Partnership	John	Thompson	Trinity River Authority
Lloyd	Kirkham	Liberty County	Robert	Van Hook	U.S. Army Corps of Engineers: Galveston
Chester	Levy	TWCA Irrigation/ Drainage District Panel	Danny	Vance	Trinity River Authority
Sarah	Loudermilk	Big Thicket Conservation Assn.	Gary	Waits	Citizen
Gaylan	Lyon	Citizen	Floyd	Watson	Shelby County
Jerry	Mambretti	Texas Parks and Wildlife Dept, Coastal	S. A.	Webb	Beaumont
Brandt	Manchen	Sierra Club - Houston	Fred	Werner	US Fish & Wildlife Service
Carl	Masterson	Houston-Galveston Area Council of Governments	Paul	Whitefield	National Parks Service, Big Thicket
Thomas	Mayfield	Hardin County	Page	Williams	Houston Audubon

# Appendix C

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

<i>No.</i>	<i>Statewide PMC</i>	<i>Southeast PMC</i>	<i>Southeast TAC</i>
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

<i>No.</i>	<i>Date</i>	<i>Group/Organization</i>	<i>Location</i>
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

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# Appendix E

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Southeast Area Water Availability with Advanced Conservation Strategy<sup>1</sup>

Amount (Thousands of Acre/Feet-Year)

<i>Category</i>	<i>Sabine</i>	<i>Neches</i>	<i>Neches-</i>		<i>Trinity-</i>		<i>San</i>		<i>Total</i>
			<i>Trinity</i>	<i>Trinity</i>	<i>San</i>	<i>Jacinto</i>	<i>Jacinto-</i>	<i>Brazos</i>	
<b>2000</b>									
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
<b>Net Surface Water Availability</b>	<b>844.3</b>	<b>207.6</b>	<b>0.0</b>	<b>693.2</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>43.4</b>	<b>1788.5</b>
<b>2010</b>									
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
<b>Net Surface Water Availability</b>	<b>835.9</b>	<b>196.4</b>	<b>0.0</b>	<b>460.1</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>14.3</b>	<b>1506.7</b>
<b>2020</b>									
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
<b>Net Surface Water Availability</b>	<b>826.8</b>	<b>199.0</b>	<b>0.0</b>	<b>319.8</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>-9.7</b>	<b>1335.8</b>

Amount (Thousands of Acre/Feet-Year)

<i>Category</i>	<i>Sabine</i>	<i>Neches</i>	<i>Neches- Trinity</i>	<i>Trinity</i>	<i>Trinity- San Jacinto</i>	<i>San Jacinto</i>	<i>San Jacinto- Brazos</i>	<i>Brazos</i>	<i>Total Southeast</i>
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
<b>Net Surface Water Availability</b>	<b>816.8</b>	<b>191.9</b>	<b>0.0</b>	<b>226.3</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>-44.5</b>	<b>1190.5</b>
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
<b>Net Surface Water Availability</b>	<b>804.3</b>	<b>168.3</b>	<b>0.0</b>	<b>168.8</b>	<b>0.0</b>	<b>-82.0</b>	<b>0.0</b>	<b>-103.0</b>	<b>956.4</b>
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
<b>Net Surface Water Availability</b>	<b>791.5</b>	<b>143.7</b>	<b>0.0</b>	<b>156.5</b>	<b>-11.3</b>	<b>-155.7</b>	<b>-32.6</b>	<b>-158.0</b>	<b>734.0</b>



# Appendix F

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