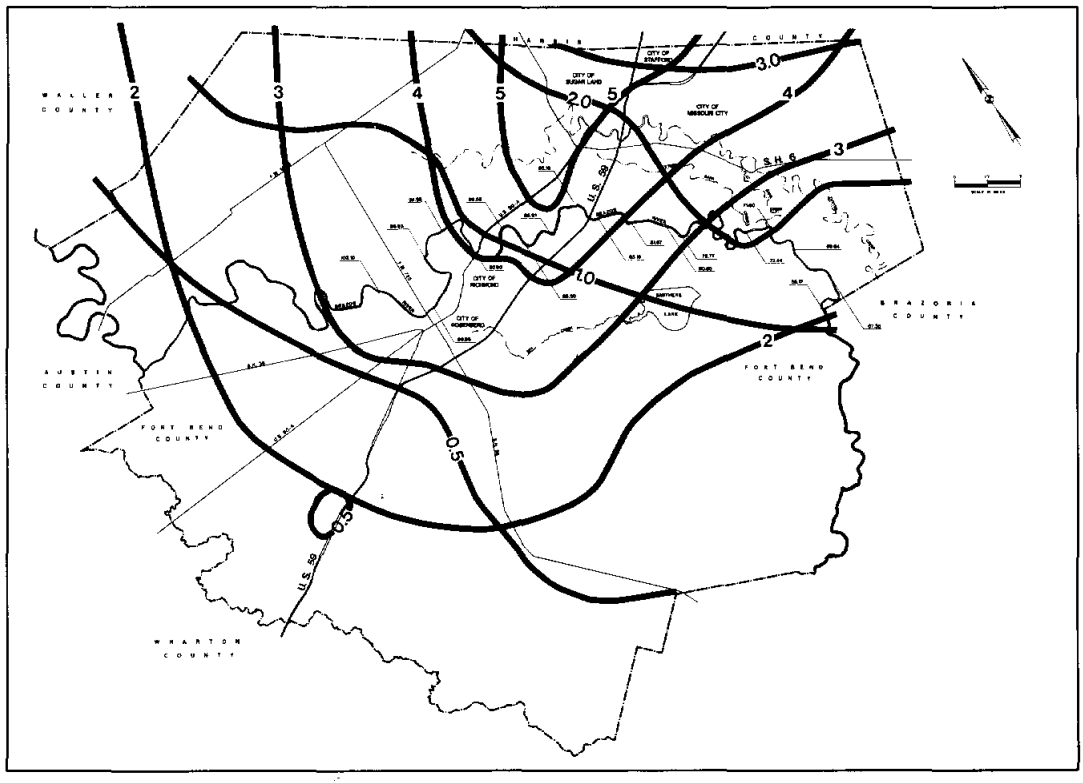
Fort Bend County
Surface Water Supply Study
Phases 1 and 2

Prepared for:

Fort Bend County
Surface Water Supply Corporation



by

A Joint Venture of

Lichliter/Jameson & Associates, Inc.
and
Turner Collie & Braden, Inc.

January, 1993

FORT BEND COUNTY
SURFACE WATER SUPPLY STUDY
PHASES 1 AND 2

PREPARED FOR
FORT BEND COUNTY SURFACE WATER SUPPLY CORPORATION

BY

A JOINT VENTURE OF
LICHLITER/JAMESON & ASSOCIATES, INC.
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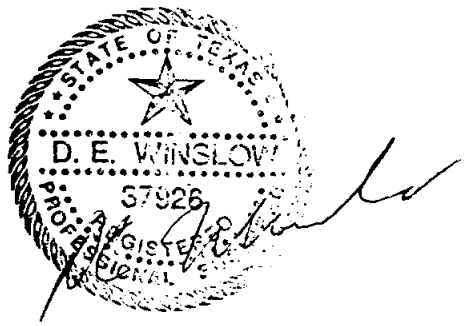


January, 1993

Fort Bend County

Surface Water Supply Study

Phase 1

FORT BEND COUNTY SURFACE WATER SUPPLY STUDY - PHASE 1

EXHIBITS

FORT BEND COUNTY SURFACE WATER SUPPLY STUDY - PHASE 1

SECTION I - INTRODUCTION

GENERAL

Fort Bend County has long recognized the need to manage its water resources, which to date is comprised of groundwater for public supply and a combination of groundwater and surface water for other uses. The county now has in place a county-wide subsidence district which is currently developing a plan to regulate groundwater withdrawal. It is anticipated that as the county continues to grow, limitations will be placed on the usage of groundwater to control subsidence and to more effectively utilize the county's groundwater resources. Technical information is needed to identify what the potential impacts of subsidence are in terms of increased flood damage, so that appropriate decisions may be made regarding the need and timing of conversion to surface water. If limitations are placed on groundwater usage, alternative supplies from surface water sources must be developed if the county is to continue to grow. A water supply technical and management plan for the entire county must be developed to identify cost-effective solutions to the current and future water needs of Fort Bend County.

Several previous studies in the Fort Bend County area, some of which were partially funded through the Texas Water Development Board (TWDB) planning grants, have been performed to develop plans for conversion of specific political subdivisions to surface water. These studies were performed before the Fort Bend County Subsidence District (FBCSD) was created. Generally these studies have started with the assumption that specific areas must convert to surface water and then have proceeded to develop individual plans for conversion. No analysis has been performed in these studies to determine the impact of subsidence on flooding and to determine specifically where and when conversion to surface water is necessary. These individual plans may not be the most cost-effective and economical approach to provide surface water if and when it is needed. Also, if a more regional approach were taken with regard to groundwater withdrawal, certain areas that have been recommended for conversion may not need to convert to surface water at least for long periods of time. Because of these factors, it was proposed that this study be performed to address on a broader scale the question of when and where conversion to surface water should occur.

In November of 1990, Fort Bend County petitioned to the Texas Water Development Board for a planning grant to develop a regional water supply plan. To organize the regional planning approach and to

SECTION II - BACKGROUND

GENERAL

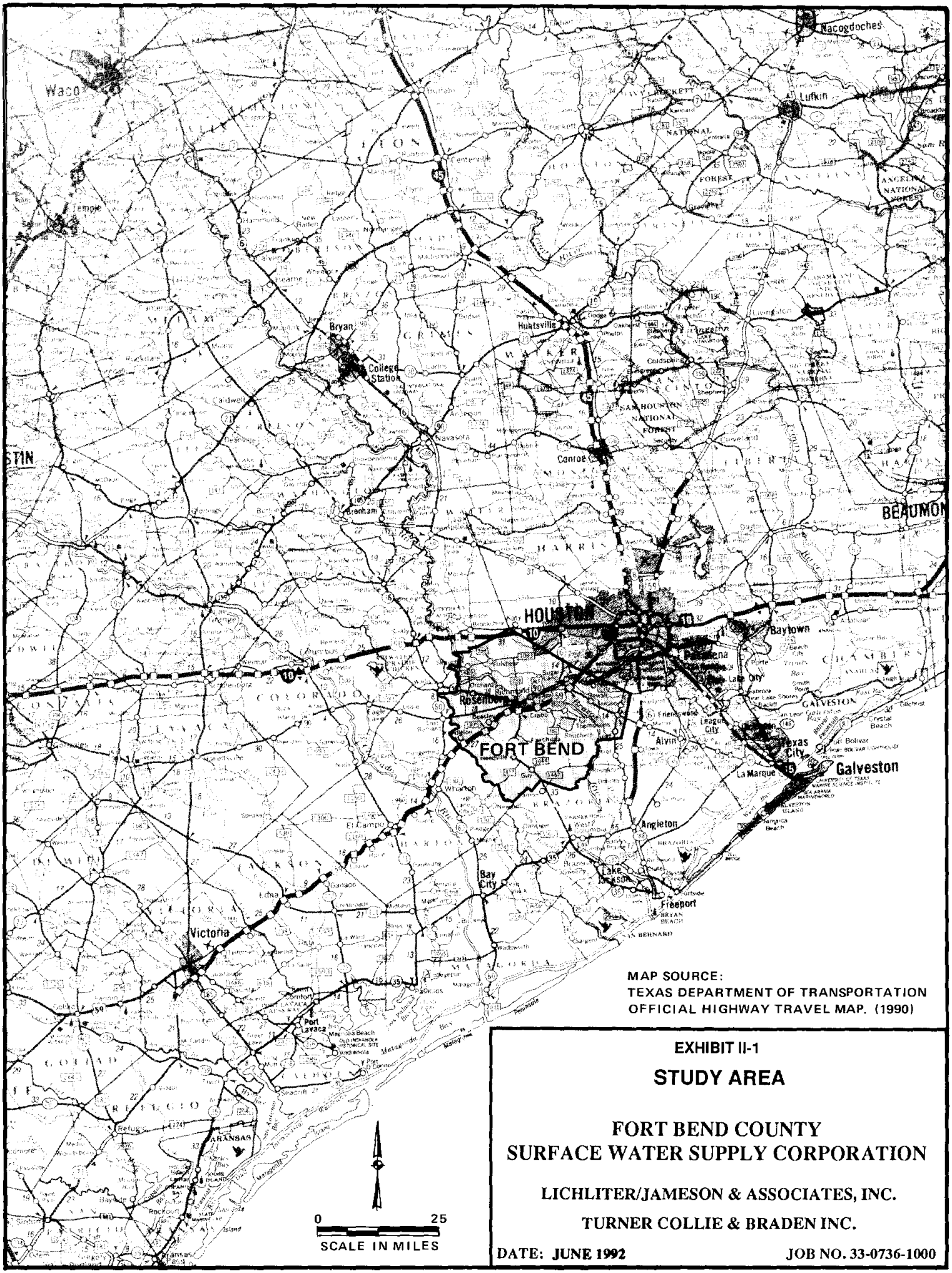
The population in Fort Bend County increased from 130,846 to 225,421 between 1980 and 1990. In 1990 municipal water demand comprised 37.0 million gallons per day (mgd), obtained almost exclusively from groundwater. The Gulf Coast aquifers underlying Fort Bend County currently supply all municipal demand in the County as well as most irrigation, agriculture, and industrial demands. The overall rate of groundwater withdrawal in the Houston, Texas area, including Fort Bend County, has resulted in the lowering of potentiometric levels, or the water table in an aquifer under pressure, and the consolidation of underlying clay layers within the aquifers. This compaction has resulted in land subsidence of as much as three feet in some of the most populous areas in Fort Bend County in the period from 1964 to 1990. Declining potentiometric levels has resulted in land subsidence which has contributed to increased flooding, ground faulting, and deterioration in water quality in other portions of the region, particularly the coastal areas along Galveston Bay in eastern Harris and Galveston Counties.

The projected increase in water demand combined with the history of subsidence has resulted in a growing concern about future water supplies in Fort Bend County. In 1989, the Texas Legislature established the Fort Bend Subsidence District to manage the groundwater resources in the County. This agency has focused on developing an inventory of groundwater wells and establishing a permitting procedure for all wells greater than five inches in diameter. However, no single entity in Fort Bend County exists to coordinate the county's water supplies for future growth.

STUDY AREA

The planning area for this study coincides with the geographical boundary of Fort Bend County in southeast Texas, as shown on Exhibit II-1. The county encompasses approximately 876 square miles and includes the cities of Arcola, Fulshear, Kendleton, Meadows, Missouri City, Needville, Orchard, Pleak, Richmond, Rosenberg, Simonton, Stafford, and Sugar Land. Also included are the towns of Beasley and Thompson, various municipal utility districts, and portions of the cities of Houston and Katy, which lie within Fort Bend County.

The planning area generally lies in the Brazos River Basin. The San Bernard River forms the southwestern boundary and also drains part of the county. In addition, a small portion of eastern Fort Bend County drains to the San Jacinto River. Soils vary from rich alluvium in the flood plain of the Brazos River to black, sandy loam, and clay on the prairies. Fort Bend County has ground surface elevations that range from 46



MAP SOURCE:
TEXAS DEPARTMENT OF TRANSPORTATION
OFFICIAL HIGHWAY TRAVEL MAP. (1990)

EXHIBIT II-1

STUDY AREA

FORT BEND COUNTY SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: JUNE 1992 JOB NO. 33-0736-1000

SECTION III - PREVIOUS LOCAL AND REGIONAL FACILITY PLANNING STUDIES

GENERAL

Conversion from groundwater to surface water as the primary source of water supply for municipal needs has been viewed as the most viable option to reduce the county's dependence on groundwater. Previous studies in and around Fort Bend County have addressed the feasibility of implementing surface water conversion. These studies focused on service areas delineated by the limits of political jurisdiction of cities or districts. This approach has resulted in four separate plans serving the areas shown on Exhibit III-1. The following paragraphs describe these previous water supply planning studies pertinent to Fort Bend County.

A REGIONAL WATER SUPPLY PLANNING STUDY FOR THE HARRIS-GALVESTON COASTAL SUBSIDENCE DISTRICT

In 1989, Harris-Galveston Coastal Subsidence District (HGCSD) initiated a study that projected the quantity and spatial distribution of water demands for the 13-county planning area surrounding Houston, Texas through year 2030. The planning area included Fort Bend County.

Although the HGCSD examined the water needs in the 13 county areas in order to access the potential impact on water levels in the aquifer and resulting ground subsidence, its enabling legislation limits its regulatory authority to Harris and Galveston counties. Consequently, its detailed regulatory action plan, which calls for the transition from groundwater to surface water, is based solely on its ability to require this conversion within its jurisdiction, without regard to what is happening outside of its jurisdiction.

In evaluating alternatives for water supply planning for Harris and Galveston Counties, the HGCSD examined the potential impact on land subsidence if all future water demand through the year 2030 was to be supplied through groundwater production. This scenario showed subsidence in excess of nine feet in Harris County and seven feet in Fort Bend County. The scenario was considered a worst case benchmark from which a regulatory action plan was adopted requiring timed conversion to surface water in Harris and Galveston Counties to mitigate the extreme subsidence potential.

The HGCSD study produced results significant to the current study effort, because projections were made of population growth, water demand, and anticipated ground subsidence in Fort Bend County. These findings have, for the most part, been adopted for use in this current study.

The stated basis for conversion to use of surface water is the need to secure a reliable, long-term source of water supply in light of declining water tables which may lead to subsidence and/or deterioration in water quality. The BBWA proposed conversion plan will use approximately 80 to 90 percent surface water to supply study-area demand. Two surface water treatment plants are proposed to be constructed, one centrally located in each of the two areas.

The BBWA's phasing schedule is to be based on existing demand. It is anticipated that surface water conversion would begin by the year 2000 and would expand incrementally to keep pace with study-area population growth.

REGIONAL WATER SUPPLY AND PLANNING STUDY FOR FORT BEND WATER CONTROL AND IMPROVEMENT DISTRICT (WCID) NO. 2 AND SUGAR LAND

The Sugar Land/FBWCID No. 2 study area is comprised of approximately 21,000 acres including Fort Bend WCID No. 2, the City of Sugar Land, and First Colony. The population at the time of the Sugar Land/FBWCID No. 2 study was approximately 50,000 persons served solely by groundwater production.

The basis of the Sugar Land/WCID No. 2 study's recommendation to convert to surface water was that although inland areas are not at risk from tidal flooding, land surface subsidence does impact local storm sewers, rivers, and levee drainage systems.

WCID No. 2 includes approximately 6,880 acres. The area is predominantly commercial and industrial, with several areas of residential development. In 1987, it was 15 to 20 percent fully developed with a population of 9,000 people with an average water usage of 2.6 million gallons per day. The City of Sugar Land includes an area of 7,150 acres and is predominantly residential with a mixture of industrial and commercial developments. The area in 1987 was 30 percent developed with approximately 16,000 persons living within city limits. Water usage averaged 3.5 mgd. First Colony is a master-planned community of residential developments and a few scattered commercial developments. In 1987, approximately 24,000 people inhabited its 6,600 acres. Average daily water use was 3.3 mgd.

Sixty wells have been drilled in the study area since 1921. Eighty percent have diameters greater than six inches and are considered large capacity wells. A total of 178 wells exist in the Sugarland/WCID No. 2 study area.

The Sugar Land/WCID No. 2 study proposes construction of an initial 16-mgd surface water plant and ultimate conveyance lines to provide 80 percent of the study area's anticipated water demand by the year

WEST HARRIS COUNTY SURFACE WATER SUPPLY CORPORATION (WHCSWSC) IMPLEMENTATION PLAN

The WHCSWSC study area is bounded by Spring Creek to the north, the Harris County line to the west and south, COH city limits to the east, and F.M. 149 to the northwest. The planning area lies in the San Jacinto River Basin, but additional major rivers and reservoirs lie in the adjacent Brazos and Trinity River basins. The water demand for the study area in 1980 was 16.14 mgd. By 1986, this figure increased to 35.80 mgd. The study area demand is projected to reach 124.5 mgd by year 2020.

The proposed alternative, termed the Southwest Supply System, transports raw water from the Brazos River Basin via the Brazos River and/or Canals "A" and "B" to the plant. A potential source of surface water is the construction of Allen's Creek Reservoir, which was originally proposed by Houston Lighting and Power Company to supply water for a power plant. HL&P received all necessary federal permits required under the Clean Water Act to construct the reservoir, but has subsequently allowed the permit to lapse. Assuming this reservoir is constructed, and water previously committed to HL&P is recaptured, the BRA offered a permanent average daily water supply of up to 133 mgd (226 mgd maximum daily) at the time of the WHCSWSC study.

The final recommended plan of the WHCSWSC study would use raw water from the Brazos River basin as the surface water source to serve the entire WHCSWSC planning area. Eighty percent of projected demand would be supplied by surface water. The remaining 20 percent would be satisfied through use of existing groundwater wells.

In the WHCSWSC plan, raw water storage would be required in the first phase to limit chloride concentrations in the raw water to below 250 mg/l. As in previously mentioned studies, the required raw water storage volume is an 18-day supply. It is anticipated that operation of the Allen's Creek Reservoir would insure a chloride concentration of below 150 mg/l. The WHCSWSC met with GCWA to discuss the possibility of using Oyster Creek or the Sugar Land lakes for surface water supply. This idea was discarded because GCWA uses these lakes as a buffer between the Brazos River lift station and its second lift station near Dulles Avenue. Low chloride levels also were unable to be guaranteed. This conclusion to exclude the lakes from consideration as a water supply source was contradictory to the recommendations of the Sugar Land/WCID No. 2 study.

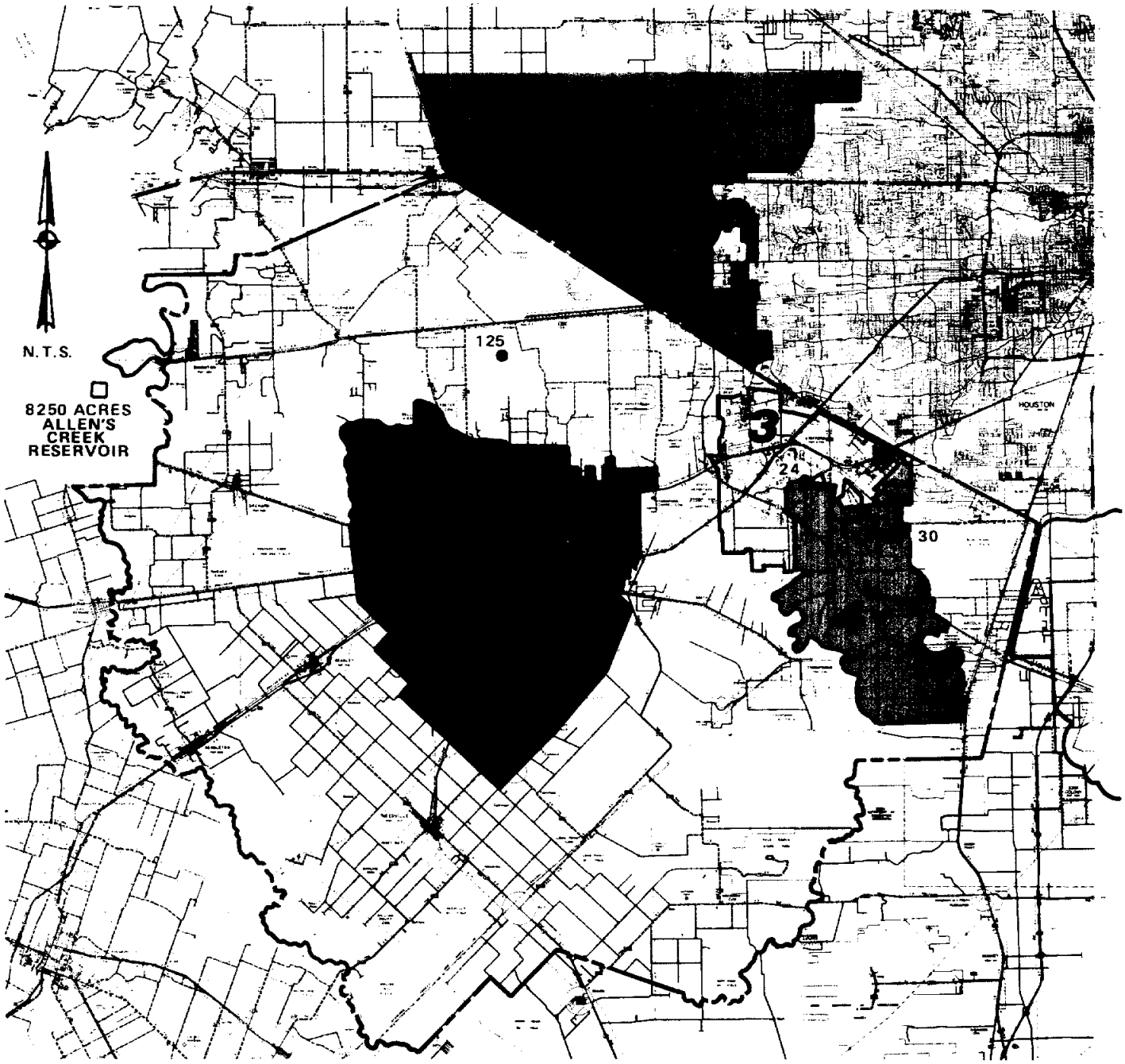
Construction of a surface water treatment plant under the recommended Southwest Supply System was to be implemented in five phases as follows:

2) Future subsidence in Fort Bend County will largely depend on the amount of groundwater used in western Harris County. To a lesser extent, the amount of conversion to surface water required in Harris County is affected by the extent of surface water implemented in Fort Bend County.

3) The City of Houston's recommended plan of action includes construction of a surface water plant in southwest Houston, somewhere near or in Fort Bend County.

4) Environmental constraints are likely to delay construction of any new reservoirs that are not currently planned and permitted.

5) Sufficient water rights are available in the Brazos River Basin to supply the total municipal water demand in Fort Bend County throughout the planning period.



LEGEND

1	WEST HARRIS COUNTY SURFACE WATER SUPPLY CORPORATION
2	CITIES OF RICHMOND AND ROSENBERG AND SURROUNDING AREAS
3	FORT BEND COUNTY WC & ID NO.2 AND CITY OF SUGARLAND
4	BRAZOS BEND WATER AUTHORITY
———	FORT BEND COUNTY LINE
●	PROPOSED SURFACE WATER TREATMENT PLANT – CAPACITY (mgd) IN 2030
□	PROPOSED TERMINATION STORAGE

EXHIBIT III-1

PREVIOUS STUDY AREAS AND ALLEN'S CREEK RESERVOIR

FORT BEND COUNTY SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC

TURNER COLLIE & BRADEN INC.

DATE: JUNE, 1992

JOB No. 33-0736-1000

SECTION IV - EXISTING WATER SUPPLY FACILITIES

GENERAL

Fort Bend County currently relies predominantly on groundwater to supply its municipal water demands, as well as large portions of its agricultural, commercial and industrial water-related demands. Many cities and municipal utility districts (MUD) within the county operate independent water supply systems to serve their citizens. It is common for one MUD to serve two or more districts, while persons living in rural areas often are served by independently owned wells. Surface water currently is used to serve some industrial demand within the county as well as some of the irrigation needs.

SOURCES OF WATER

Aquifer System

Fort Bend County's primary source of potable groundwater is the Gulf Coast aquifer system shown in Exhibit IV-1. In Fort Bend County, water is withdrawn from the Chicot aquifer underlain by the Evangeline aquifer. The Chicot aquifer is a multi-layered aquifer with discontinuous lenses of clay, silt, sand, and gravel. The southeastern area of the county contains an intermediate clay layer 200 to 300 feet below the land surface which separates the Chicot aquifer into upper and lower units. The Chicot aquifer is in the Holocene and Pleistocene geologic series. Stratigraphic units within the Chicot aquifer are the Willis Sand, Bentley Formation, Montgomery Formation, Beaumont Clay, and Quaternary alluvium. Aquifer thickness in the county ranges from 400 feet in the northern part to 1,200 feet in the southern part. Sand percentages within the aquifer ranges from 40 percent in the eastern part of the county to 75 percent in the north and northwestern parts of the county. Approximate transmissivity values for the Chicot aquifer range from 6,000 ft^2/d to 12,000 ft^2/d. The storage coefficient for the aquifer ranges from approximately 0.0004 to 0.1. The larger values occur where unconfined conditions are present. Confined beds within the aquifer produce the majority of the groundwater. Unconfined beds in the northern area of the county near Katy, Texas represent the remaining production.

The Evangeline aquifer lithology is similar to the Chicot aquifer but differs by having a finer grained sand, a smaller sand-to-clay ratio, a smaller hydraulic conductivity, and lower water levels. The stratigraphic unit name corresponding to this aquifer is the Goliad Sand and is from the Pliocene geologic series. The thickness of the Evangeline aquifer varies from 1,200 feet in the north part of the county to 2,200 feet in the south. The percentage of sand layers ranges from 33 to 44 with the thickest sand beds and water section in the eastern half of the county. The transmissivity of the Evangeline aquifer range from approximately 6,000 ft^2/d to 10,500 ft^2/d. The storage coefficient ranges from approximately 0.0004 to 0.0006.

Growth in the county has resulted in the drilling of more than 90 large-capacity (greater than 500 gpm) wells since 1969. Fifty-seven of these wells were drilled for public supply, 23 for irrigation, and 10 for industrial purposes. Fifty of the fifty-seven public supply wells were drilled in northeast Fort Bend County. These wells, shown in Exhibit IV-2, have an average depth of 1,180 feet and an average yield of 1,460 gpm. In 1987, 69 large-capacity public supply wells were in use. Sixty-one of those wells were located north of the Brazos River in the northeastern area of Fort Bend County. The typical public supply well drilled in the northeastern part of the county has, on the average, 260 feet of panel screened between 700 and 1,150 feet below land surface. Approximately 80 percent of the screened sections are in the Evangeline aquifer.

Groundwater use for public supply increased from approximately four mgd in 1969 to 28 mgd in 1986. Most of this increase occurred because of urbanization of the northeastern part of the county. In this area, the withdrawal in 1969 was two mgd and grew to 22 mgd by 1986.

Presently, groundwater from these aquifers meets the State of Texas drinking water standards for heavy metals, organic compounds, and radiological properties. In November, 1991, the Texas Department of Health (TDH) noted no violators in Fort Bend County on its Maximum Concentration Level (MCL) violation list. The 1990 TDH water quality data for Fort Bend County demonstrates that public water supply systems are of high quality.

Surface Water

The aquifer system adequately supplies all potable water needs for the county. However, treated surface water may be needed to supplement groundwater supplies in the future. The following is a list of possible water sources for Fort Bend County:

- Brazos River Authority - Brazos River
- Richmond Irrigation Canal - Brazos River
- Galveston County Water Authority - Canals A and B - Brazos River
- City of Houston - San Jacinto River (already treated)
- San Jacinto River Authority - San Jacinto River
- Trinity River Authority - Trinity River

Two agencies are capable of supplying large quantities of raw surface water for areas of Fort Bend County without requiring construction of major transmission facilities. These are the Brazos River Authority (BRA) and the Gulf Coast Water Authority (GCWA). The source of water controlled by both of these agencies is the Brazos River.

With a total drainage area of 45,573 square miles, the Brazos River basin is the second-largest river basin in Texas. The basin is over 840 miles long and varies in width from 110 miles near Waco to about one mile near its mouth at the Gulf of Mexico. There are 12 major reservoirs in the Brazos River basin with many more smaller reservoirs. Three of the larger reservoirs are owned by the BRA, while the remaining nine are owned by the U.S. Army Corps of Engineers (USAE).

Brazos River water currently is used primarily for industrial and agricultural needs. Much of the water is used as cooling water by power companies. The water quality has been monitored by USGS for over 20 years. Parameters of concern pertinent to surface water treatment are concentrations of dissolved solids, chlorides, and sulfates. A statistical analysis of the historical water quality data, performed as part of the City of Sugar Land/WCID No. 2 study, concluded that of 95 percent of samples taken, total dissolved solids were less than, or equal to, 730.0 milligrams per liter (mg/l), chlorides were less than or equal to 240.0 mg/l, and sulfates were less than or equal to 130.5 mg/l. Large reservoir releases from the upper part of the basin may alter this quality. Raw water taken from the Brazos River is characteristically high in color, with variable turbidity, high organic content, high iron, and seasonally high algae content. The high algae and organic content of the raw water create a potential for taste and odor problems to develop during treatment and distribution.

That same study has indicated a historical water quality data shows that the chloride concentration limit is below the Environmental Protection Agency's (EPA) recommended level of 250 mg/l in 95 percent of the samples taken. The previous studies make the assumption that an alternate source of water must be available for use five percent of each year, or 18 not necessarily consecutive days.

The BRA is the basin-planning organization for the Brazos River basin and was created in 1971. Currently there are more than 200 contracts with the BRA to divert approximately 357 mgd of the basin water that is stored in reservoirs operated or controlled by BRA. Typically, most contracts are long-term, approximately 50 years. Each contains a renewal clause and a perennial option for continued water use.

In January, 1992, the BRA met to determine the cost of its raw water. System water, which is defined as water available for current use and available for immediate diversion, costs $22.22/acre-foot or $0.068/1,000 gallons. Option water, which means securing water rights of allowable water available for future diversion, costs $11.11/acre-foot or $0.034/1,000 gallons. Presently, without construction of an additional reservoir, the BRA could offer a minimum permanent average daily raw water supply of 43.7 mgd.

The BRA has proposed building Allen's Creek Reservoir (see Exhibit IV-2) which would be located approximately 25 miles west of Houston with an estimated yield of 87.5 mgd. Construction of the Allen's Creek reservoir is predicated on the existence of a large water buyer near the proposed reservoir.

The GCWA owns and operates the Tri-County canal system including Jones and Oyster Creek and the American and Briscoe Canals, or Canals A and B respectively (Exhibit IV-2). These creeks and canals have been used for many years to supply raw water to farmers, the Imperial Sugar Refinery in Sugar Land, and to municipal and industrial customers in Fort Bend, Brazoria, and Galveston counties. Jones Creek begins at the Brazos River at a pump station known as the River Pump Station south of Fulshear, Texas. The 353-mgd pump station discharges into Jones Creek, which then drains into Oyster Creek. Approximately 20 miles east of the pump station, Oyster Creek forms a series of lakes. A series of three dams control the water level in these lakes. A second pump station lifts water from Oyster Creek into a channelized section called Canal "A." Canal "A" flows south to the GCWA treatment plant near Texas City and beyond. Canal B draws water from the Brazos River six miles west of Arcola through a 302-mgd capacity pump station (Exhibit IV-2.) water then flows southeast in Canal B along Highway 6. The GCWA has control of the river water rights for 212 mgd, a portion of which is diverted into these canals. GCWA has approximately 60 mgd of raw water available for sale at a cost of $32.27/acre-foot or $0.111/1,000 gallons. If demand from the canal system exceeds available supply, it may be possible to divert additional flow from the Brazos through the canal system for use within the creek area.

Several potential surface water supplies exist outside Fort Bend County. The San Jacinto River Authority (SJRA) operates Lake Conroe on the West Fork San Jacinto River. The available yield from Lake Conroe equals 100,600 acre-feet or 90 mgd. All water in Lake Conroe is currently committed and no water rights are available for sale. To obtain water from the San Jacinto River basin would require creating available water rights, either by constructing new reservoirs, or supplementing total water availability by some other means. The cost of constructing a conveyance system combined with the relatively low volume of water required by Fort Bend County, however, make the San Jacinto River an unlikely source of water unless other entities participate. The City of Houston owns and operates Lake Houston on the San Jacinto River. The available yield from Lake Houston is 199,300 acre-feet or 178 mgd, all of which is controlled by the City of Houston.

In the Trinity River basin, Bedias Creek and the Trinity River converge to form Lake Livingston, a part of both San Jacinto and Polk counties. The Trinity River Authority (TRA) owns 30 percent of Lake Livingston; the City of Houston owns 70 percent. Total storage capacity of Lake Livingston is 1,750,000 acre feet or 1,563 mgd. The safe yield is approximately 1,538,000 acre feet or 1374 mgd. Currently, two additional reservoirs are proposed in the Trinity River Basin.

According to the City of Houston Code of Ordinances, contracts for treated water are available to any customer, or potential customer, if the customer is either a municipality or conservation and reclamation district organized under Article XVI in Section 59 of the Texas Constitution. This article mandates water purchased from the city be resold to customers of municipalities having a minimum water consumption of at least 150,000,000 gallons per month. No customer is permitted to redesignate its minimum monthly quantity more than once every 12 months. The COH has indicated that it does not have facilities in place to provide raw or treated water to Fort Bend County outside of the city limits.

WATER RIGHTS FROM THE TEXAS WATER COMMISSION

A water right is obtained by applying to the Texas Water Commission (TWC) for a permit to divert water from a surface water source. Each permit specifies a maximum amount of water to be diverted, the location of the diversion, and the use of diverted water. A "priority date" also is associated with each permit. The phrase "first in time, first in right" represents the TWC policy for distributing water. This means that a water right owner with an early date (e.g. 1900) would receive water before a water right owner with a later date (e.g. 1990). In cases of extreme drought and limited water supply, the TWC has no written amendment to adjust distribution priorities. However, in such times, adjustments may be made to reflect a priority of need. Table IV-1 lists the active water right owners for municipal and industrial use in Fort Bend County. Included in this table are the diversion amounts, priority dates, and location of diversion for each water right owner.

Water rights are perpetual and remain with the land, regardless of ownership. The owner of a water right must pay a one-time application fee and annual fees, which are related to water quality. An average permit application requires approximately six to eight months for processing. For larger projects, such as supplying the entire Fort Bend County area, the application process may take approximately two to three years. If Fort Bend County were to apply for, and obtain, a TWC permit to divert surface water from the Brazos River, the county would have a "junior" ranking priority date when compared to other TWC permits with older, "senior" rankings. Seniority determines who gets water in times of low flow. Alternatively, water users can acquire water rights from an existing water authority such as the BRA or GCWA.

PUBLIC WATER SUPPLY ENTITIES IN FORT BEND COUNTY

Prior to creation of the Fort Bend County Subsidence District (FBSD), no management system existed which recorded well location, water well production, and other information pertaining to all groundwater wells. Upon its creation in 1989, the FBSD established a water well permitting program. Anyone in the county who owns a well with an inside casing diameter greater than five inches, or who owns more than one well, is required to obtain a permit from the district. A well less than five inches in casing diameter that serves a single-family dwelling may be exempted by the district. A permit fee is established annually by the district and is levied according to the approved pumpage for each well. The permit fee for 1990 was $7.50 per million gallons of water for non-agricultural users and $5.25 per million gallons for agricultural users.

As of October, 1991, the FBSD has 545 permitted wells on record. Of those 545 wells, 174 are public water supply, 292 irrigation, and 79 industrial wells, see Table IV-2. Well locations, well numbers, utility district boundaries, corporate boundaries, and waterway systems are shown on Exhibit IV-2. Of the 70,089 acre-feet of groundwater produced in 1990, 58 percent was produced for public water supply, 31 percent for irrigation, and 11 percent for industrial needs. The water use in Table IV-2 was determined by the permitted owner identification.

Active public water supply entities in Fort Bend County are listed in Table IV-3. As of December, 1991, there were 63 entities supplying 188,035 persons with water. The average daily consumption was 30.7 million gallons through a total of 63,692 service connections produced by 84 water wells. The total production of 110.4 million gallons per day is based on the well and pumping capacity, for the entities listed in Table IV-3. Existing storage facilities total 41.3 million gallons, of which 30.5 million gallons are ground storage, and 9.8 million gallons are elevated storage. Table IV-4 lists the utility districts shown on Exhibit IV-2.

EXISTING WATER UTILITY RATES

A list of water utility rates of representative entities compiled for Fort Bend County are shown in Table IV-5. Each water district has a separate water rate structure for its customers, reflecting the different costs of water production (i.e. wells and plant facilities, transmission and distribution (pipes), number of customers, and water used). Table IV-5 compares the monthly water bill for a single family residence in 26 selected water districts in Fort Bend County. The table assumes each household would use 13,650 gallons of water per month. The cost of water in 26 districts ranges from $0.96 to $2.57 per 1,000 gallons used given the individual rate structure.

TABLE IV-1 ACTIVE WATER RIGHT OWNERS FOR MUNICIPAL AND INDUSTRIAL USE IN FORT BEND COUNTY, TEXAS

Owner Name	(1) Water Right Number	River Basin	River Order No.	Stream	Use	Authorized Diversion (AC-FT/YR)	Priority Date	Diversion Location	
								Latitude	Longitude
1. Brazos River Authority	005166	Brazos	0390000000	Brazos	Mun.	0	Not Available	29 30.24'	95 33.24'
2. Brazos River Authority	005167	Brazos	0395000000	Tribs & Brazos	Mun.	0	Not Available	29 30.24'	95 33.24'
3. Brazos River Authority	005167	Brazos	0395000000	Tribs & Brazos	Ind.	0	Not Available	29 30.24'	95 33.24'
4. Galveston County Water Authority	005168	Brazos	0400000000	Brazos	Mun.	99,932	15-Jan-26	29 30.24'	95 33.24'
5. Galveston County Water Authority	005169	San Jacinto & Brazos	4359000000	Jones Creek	Mun.	12,000	14-May-48	29 36.30'	95 35.46'
6. Fort Bend County WCID No. 1	005170	San Jacinto & Brazos	4365000000	Jones & Oyster	Mun.	18,000	14-May-48	29 37.26'	95 37.92'
7. Brazos River Authority	005171	Brazos	0420000000	Brazos	Mun.	75,000	01-Feb-39	29 35.85'	95 54.00'
8. Richmond Irr. Co. & HL&P	005320	Brazos	0480000000	Brazos	Ind.	12,000	23-Oct-26	29 34.74'	95 46.62'
9. Chocolate Bayou Water Co.	005322B	Brazos	0235000000	Brazos	Ind.	10,000	08-Feb-29	---	---
10. Houston L&P Co. Parish	005325	Brazos	0220000000	Dry	Ind.	28,711	16-Dec-55	29 29.16'	95 37.32'

NOTE:
(1) Each water right in this column was obtained by certificate of adjudication.

SOURCE: Texas Water Commission

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
101	RICHMOND, CITY OF	P	790023	6	100	15	433	CHIC.	155,489
102	RICHMOND, CITY OF	P	790023	8	100	15	451	CHIC.	155,489
103	RICHMOND, CITY OF	P	790023	10	100	15	519	CHIC.	155,489
104	RICHMOND, CITY OF	P	790023	10	100	15	848	CHIC.	155,489
105	BLUE RIDGE WEST M.U.D.	P	790051	14	70	-175	1,032	EVANG.	149,288
106	BLUE RIDGE WEST M.U.D.	P	790051	16	70	-175	1,155	EVANG.	149,288
107	FT. BEND CO. M.U.D. 2	P	790038	16	90	-200	909	EVANG.	135,479
108	FT. BEND CO. M.U.D. 2	P	790038	18	90	-200	979	EVANG.	135,479
109	HOUSTON, CITY OF	P		14	70	-225	1,045	EVANG.	309,501
110	HOUSTON, CITY OF	N		18	65	-250	1,220	EVANG.	309,501
111	HOUSTON, CITY OF	P		14	65	-130	845	EVANG.	309,501
112	HOUSTON, CITY OF	P		14	65	-130	1,050	EVANG.	309,501
113	HOUSTON, CITY OF	P		18	65	-130	1,099	EVANG.	309,501
114	HOUSTON, CITY OF - SIMS PLANT	P		24	70	-225	1,190	EVANG.	309,501
115	NEEDVILLE, CITY OF	P	790001	10	85	35	420	CHIC.	39,728
116	NEEDVILLE, CITY OF	P	790001	10	85	35	429	CHIC.	39,728
117	HOUSTON LIGHTING & POWER CO.	N	790140	4	70	-175	330	EVANG.	42
118	HOUSTON LIGHTING & POWER CO.	N	790100	4	55	-20	321	CHIC.	42
119	HOUSTON LIGHTING & POWER CO.	N	790140	4	100	15	0	CHIC.	42
120	HOUSTON LIGHTING & POWER CO.	N	790140	4	55	-50	230	CHIC.	42
121	HOUSTON LIGHTING & POWER CO.	N	790140	4	115	55	242	CHIC.	42
122	HOUSTON LIGHTING & POWER CO.	N	790140	4	65	-130	260	EVANG.	42
123	HOUSTON LIGHTING & POWER CO.	N	790140	4	100	-50	210	EVANG.	42
124	HOUSTON LIGHTING & POWER CO.	N	790100	4	110	15	326	CHIC.	42
125	HOUSTON LIGHTING & POWER CO.	N	790140	4	90	-5	242	CHIC.	42
126	HOUSTON LIGHTING & POWER CO.	N	790100	4	70	-200	345	EVANG.	42
127	HOUSTON LIGHTING & POWER CO.	N	790100	18	70	-50	702	CHIC.	135,841
128	HOUSTON LIGHTING & POWER CO.	N	790100	18	70	-50	803	CHIC.	135,841

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
129	HOUSTON LIGHTING & POWER CO.	N	790100	18	70	-50	803	CHIC.	135,841
130	HOUSTON LIGHTING & POWER CO.	N	790100	24	70	-35	851	CHIC.	135,841
131	HOUSTON LIGHTING & POWER CO.	N	790100	24	70	-35	851	CHIC.	135,841
132	HOUSTON LIGHTING & POWER CO.	N	790100	24	70	-35	850	CHIC.	135,841
133	HOUSTON LIGHTING & POWER CO.	N	790100	24	70	-50	859	CHIC.	135,841
134	ROSENBERG, CITY OF	P	790003	16	100	25	840	CHIC.	178,922
135	ROSENBERG, CITY OF	P	790003	14	100	-40	979	EVANG.	178,922
136	ROSENBERG, CITY OF	P	790003	16	100	-40	1,594	EVANG.	178,922
137	ROSENBERG, CITY OF	P	790003	18	100	-40	1,310	EVANG.	178,922
138	ROSENBERG, CITY OF	P	790003	20	100	-55	1,580	EVANG.	178,922
139	SUGAR LAND, CITY OF	P	790005	10	70	-200	1,665	EVANG.	229,064
140	SUGAR LAND, CITY OF	P	790005	10	70	-200	1,202	EVANG.	229,064
141	SUGAR LAND, CITY OF	P	790005	10	70	-200	995	EVANG.	229,064
142	SUGAR LAND, CITY OF	P	790005	10	70	-200	900	EVANG.	229,064
143	SUGAR LAND, CITY OF	P	790005	6	90	-200	960	EVANG.	229,064
144	SUGAR LAND, CITY OF	P	790005	6	90	-200	1,775	EVANG.	229,064
145	SUGAR LAND, CITY OF	P	790005	12	75	-180	1,810	EVANG.	229,064
146	GREAT SOUTHWEST EQUESTRIAN CTR	N		6	110	5	398	CHIC.	570
147	CINCO M.U.D. #1	P	790274	24	90	-5	820	CHIC.	130,968
148	FT. BEND CO. M.U.D. 37	P	790189	12	110	15	1,022	CHIC.	41,713
149	FT. BEND CO. M.U.D. 47/48	P	790220	14	70	-140	1,000	EVANG.	57,837
150	BEASLEY, TOWN OF	P	790014	10	95	45	955	CHIC.	9,221
151	BEASLEY, TOWN OF	P	790014	7	95	45	975	CHIC.	9,221
152	CHAMBERS RANCH LTD.	I		4	115	70	192	CHIC.	300
153	VENCIL, J. Q.	I		8	85	15	200	CHIC.	100
154	HOUSTON SHELL & CONCRETE CO.	N		5	70	-225	311	EVANG.	2,828
155	HOUSTON SHELL & CONCRETE CO.	N		4	70	-225	311	EVANG.	2,828
156	HOUSTON SHELL & CONCRETE CO.	N		4	80	-215	420	EVANG.	915

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
157	HOUSTON SHELL & CONCRETE CO.	N		4	80	-215	420	EVANG.	915
158	BULS ESTATE	I		8	115	65	366	CHIC.	22,000
159	BULS ESTATE	I		2	115	55	99	CHIC.	43
160	DUSEK, EDWIN	I		12	115	70	272	CHIC.	17,280
161	WESTON LAKE COUNTRY CLUB	I		10	115	60	455	CHIC.	60,000
162	TEXAS INSTRUMENTS INCORPORATED	N	790030	14	70	-225	1,020	EVANG.	130,153
163	TEXAS INSTRUMENTS INCORPORATED	N	790030	14	70	-225	934	EVANG.	130,153
164	TEXAS INSTRUMENTS INCORPORATED	N	790030	14	70	-225	1,030	EVANG.	130,153
165	WILLOWISP COUNTRY CLUB, INC.	I		4	70	-225	232	EVANG.	1,000
166	WILLOWISP COUNTRY CLUB, INC.	P		6	70	-225	450	EVANG.	20,000
167	WILLOWISP COUNTRY CLUB, INC.	P		6	70	-225	504	EVANG.	20,000
168	WILLOWISP COUNTRY CLUB, INC.	P		3	70	-225	100	EVANG.	1,000
169	FT. BEND CO. M.U.D. 23	P	790237	20	65	-60	1,338	CHIC.	5,258
170	FT. BEND CO. M.U.D. 46	P		16	70	-130	1,165	EVANG.	1,555
171	FT. BEND CO. M.U.D. 50	P	790277	20	110	5	1,210	CHIC.	13,522
172	NEEDVILLE I.S.D.	P		4	70	15	140	CHIC.	4,170
173	NEEDVILLE I.S.D.	P		4	70	15	140	CHIC.	4,170
174	UNITED SALT CORP.	N		12	65	-130	488	EVANG.	33,760
175	VENETIAN ESTATE PROP OWNER ASSO	P		16	70	-200	0	EVANG.	154,212
176	QUANEX CORP GULF STATES TUBE DI	N	790057	20	100	-20	875	EVANG.	28,062
177	QUANEX CORP GULF STATES TUBE DI	N	790057	20	100	-20	1,178	EVANG.	28,062
178	FT. BEND UTILITIES CO.	P	790067	10	75	-180	775	EVANG.	0
179	FT. BEND UTILITIES CO.	P	790067	8	75	-180	1,570	EVANG.	174,486
180	FT. BEND UTILITIES CO.	I	790067	10	75	-180	876	EVANG.	174,486
181	FT. BEND UTILITIES CO.	N	790067	13	75	-180	1,025	EVANG.	174,486
182	UNITED GAS PIPELINE CO.	N		8	70	40	363	CHIC.	69
183	UNITED GAS PIPELINE CO.	N		8	70	40	365	CHIC.	69
184	EXXON CORPORATION	N		4	75	-70	380	EVANG.	12

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
185	EXXON CORPORATION	N		2	55	-20	130	CHIC.	4
186	EXXON CORPORATION	N		4	55	-20	130	CHIC.	0
187	EXXON CORPORATION	N		6	55	-20	130	CHIC.	1,660
188	EXXON CORPORATION	N		6	55	-20	130	CHIC.	313
189	EXXON CORPORATION	N		6	55	-20	130	CHIC.	574
190	EXXON CORPORATION	N		4	55	-20	130	CHIC.	11,444
191	EXXON CORPORATION	N		4	55	-20	130	CHIC.	0
192	EXXON CORPORATION	N		4	55	-20	130	CHIC.	0
193	EXXON CORPORATION	N		4	55	-20	130	CHIC.	0
194	EXXON CORPORATION	N		4	55	-20	100	CHIC.	0
195	EXXON CORPORATION	N		4	70	-130	290	EVANG.	1,333
196	WITCO CORPORATION	N		6	65	-130	618	EVANG.	13,470
197	WITCO CORPORATION	N		6	65	-130	596	EVANG.	13,470
198	WITCO CORPORATION	N		6	65	-130	379	EVANG.	13,470
199	FLEXICORE OF TEXAS, INC.	N		5	65	-130	430	EVANG.	270
200	FLEXICORE OF TEXAS, INC.	N		5	65	-130	260	EVANG.	1,080
201	FLEXICORE OF TEXAS, INC.	N		5	65	-130	200	EVANG.	1,080
202	MEADOWS M.U.D., THE	P	790025	16	80	-215	1,040	EVANG.	126,982
203	MEADOWS M.U.D., THE	P	790025	16	80	-215	1,035	EVANG.	126,982
204	KATY, CITY OF	P		16	115	15	644	CHIC.	101,100
205	CALPERS	I		10	70	-200	555	EVANG.	29,685
206	BANFIELD, NEIL A.	I		24	115	70	950	CHIC.	166,667
207	BANFIELD, NEIL A.	I		24	115	70	954	CHIC.	166,667
208	BANFIELD, NEIL A.	I		18	115	55	450	CHIC.	166,667
209	FRITO-LAY, INC.	N	790169	8	100	30	350	CHIC.	108,917
210	FRITO-LAY, INC.	N	790169	8	100	30	350	CHIC.	108,917
211	FRITO-LAY, INC.	I	790169	12	100	30	422	CHIC.	0
212	MILL BROOK WATER & SANITARY,INC.	P		6	85	25	312	CHIC.	6,477

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
213	MILL BROOK WATER & SANITARY,INC.	P		4	85	25	230	CHIC.	6,477
214	MILL BROOK WATER & SANITARY,INC.	P		4	85	25	232	CHIC.	6,477
215	KRAUSE, GARRETT C.	I		12	95	55	292	CHIC.	5,000
216	KRAUSE, GARRETT C.	I		4	95	55	120	CHIC.	60
217	FT. BEND CO. M.U.D. 81	P	790268	8	115	60	450	CHIC.	24,333
218	FT. BEND CO. M.U.D. 81	P	790268	14	115	60	650	CHIC.	24,333
219	FT. BEND CO. M.U.D. 81	P	790268	16	115	60	450	CHIC.	24,333
220	FT. BEND CO. W.C.&I.D. 2	P	790004	14	70	-225	1,600	EVANG.	183,854
221	FT. BEND CO. W.C.&I.D. 2	P	790004	16	70	-225	1,625	EVANG.	183,854
222	FT. BEND CO. W.C.&I.D. 2	P	790004	16	70	-200	1,625	EVANG.	183,854
223	FT. BEND CO. W.C.&I.D. 2	N	790004	16	70	-225	1,690	EVANG.	183,854
224	FT. BEND CO. W.C.&I.D. 2	P	790004	16	70	-225	1,433	EVANG.	183,854
225	FT. BEND CO. W.C.&I.D. 2	P	790004	20	70	-225	2,000	EVANG.	183,854
226	PECAN GROVE COUNTRY CLUB	P		14	75	-70	313	EVANG.	28,000
227	PECAN GROVE COUNTRY CLUB	P		8	75	-70	510	EVANG.	55,000
228	PECAN GROVE M.U.D.	P	790132	8	75	-70	542	EVANG.	137,238
229	PECAN GROVE M.U.D.	P	790132	18	75	-70	1,410	EVANG.	137,238
230	PECAN GROVE M.U.D.	P	790132	20	75	-70	900	EVANG.	137,238
231	PECAN GROVE M.U.D.	P	790132	24	75	-70	936	EVANG.	137,238
232	PLANTATION M.U.D.	P	790112	16	75	-40	810	CHIC.	58,230
233	PLANTATION M.U.D.	P	790112	16	75	-40	804	CHIC.	58,230
234	FT. BEND CO. M.U.D. 42	P		20	70	-165	1,092	EVANG.	25,362
235	BIG OAKS M.U.D.	P		10	90	-170	730	EVANG.	551
236	CHELFORD CITY M.U.D.	P		16	90	-170	1,360	EVANG.	167,118
237	CHELFORD CITY M.U.D.	P		16	90	-170	815	EVANG.	167,118
238	FT. BEND CO. M.U.D. 13	P	790072	24	70	-150	1,644	EVANG.	420,499
239	FT. BEND CO. M.U.D. 13	P	790072	24	70	-150	1,105	EVANG.	420,499
240	FT. BEND CO. M.U.D. 13	P	790072	24	75	-90	1,070	CHIC.	420,499

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
241	FT. BEND CO. M.U.D. 25	P	790130	16	75	-180	1,050	EVANG.	47,346
242	FT. BEND CO. M.U.D. 25	P	790130	16	75	-130	924	EVANG.	47,346
243	FT. BEND CO. M.U.D. 30	P	790146	10	90	-170	878	EVANG.	113,952
244	FT. BEND CO. M.U.D. 34	P	790200	20	110	5	1,105	CHIC.	23,001
245	FT. BEND CO. M.U.D. 41	P	790229	16	90	-200	1,565	EVANG.	23,771
246	FT. BEND CO. M.U.D. 69	P	790253	20	75	-40	1,058	CHIC.	64,569
247	GRAND MISSION M.U.D.	P		10	90	-5	734	CHIC.	2,643
248	KINGSBRIDGE M.U.D.	P	790158	20	90	-200	1,505	EVANG.	187,349
249	MISSION BEND M.U.D. 1	P		24	90	-170	884	EVANG.	138,571
250	NORTH MISSION GLEN M.U.D.	P		10	90	-170	1,400	EVANG.	60,016
251	VIA RANCH M.U.D. 4	P		10	110	5	643	CHIC.	3,024
252	FT. BEND CO. M.U.D. 26	P	790137	16	70	-175	1,190	EVANG.	44,959
253	FT. BEND CO. M.U.D. 26	P	790137	8	70	-175	403	EVANG.	44,959
254	BAYLOR COMPANY	N		4	70	-200	450	EVANG.	600
255	BAYLOR COMPANY	N		4	70	-200	320	EVANG.	600
256	MEADOWCREEK M.U.D.	P	790049	14	70	-165	1,130	EVANG.	113,740
257	QUAIL VALLEY U.D.	P	790028	12	70	-165	1,200	EVANG.	151,888
258	QUAIL VALLEY U.D.	P	790028	18	70	-165	1,320	EVANG.	151,888
259	QUAIL VALLEY U.D.	P	790028	18	70	-175	1,077	EVANG.	151,888
260	QUAIL VALLEY U.D.	P	790028	20	70	-165	1,325	EVANG.	151,888
261	THUNDERBIRD U.D.	P	790033	16	70	-130	1,074	EVANG.	140,306
262	THUNDERBIRD U.D.	P	790033	14	70	-140	1,167	EVANG.	140,306
263	THUNDERBIRD U.D.	P	790033	14	70	-175	1,314	EVANG.	67,340
264	PALMER PLANTATION M.U.D. 1	P	790199	16	70	-130	1,225	EVANG.	53,609
265	WENDT FARMS, EAJL	I		18	95	45	360	CHIC.	106,800
266	WENDT FARMS, EAJL	I		20	95	50	523	CHIC.	106,800
267	WENDT FARMS, EAJL	I		20	95	45	623	CHIC.	106,800
268	WENDT FARMS, EAJL	I		20	95	45	591	CHIC.	106,800

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
269	WENDT FARMS, EAJL	I		20	95	45	655	CHIC.	106,800
270	WENDT FARMS, EAJL	I		18	95	45	400	CHIC.	90,000
271	WENDT FARMS, EAJL	I		14	95	45	250	CHIC.	90,000
272	WENDT FARMS, EAJL	I		20	95	45	564	CHIC.	90,000
273	BUXKEMPER, FRANK JR.	I		12	95	65	295	CHIC.	21,000
274	PARR, KEN D.	I		4	100	-65	300	EVANG.	200
275	QUAIL VALLEY COUNTRY CLUB	P		8	70	-130	470	EVANG.	10,000
276	QUAIL VALLEY COUNTRY CLUB	P		12	70	-165	747	EVANG.	30,000
277	HOUSTON LIGHTING & POWER CO.	N	790140	4	55	-50	0	CHIC.	100
278	HOUSTON LIGHTING & POWER CO.	N	790140	4	55	-50	230	CHIC.	100
279	FIRST COLONY M.U.D. 9	P	790230	24	70	-165	1,205	EVANG.	147,647
280	DRACHENBERG, RON	I		4	95	55	150	CHIC.	0
281	DRACHENBERG, RON	I		12	95	55	500	CHIC.	0
282	ONSTAD, WARD K.	I		4	100	-65	120	EVANG.	50
283	SMITH, R.E. TESTAMENTARY TRUSTS/	I		6	115	45	0	CHIC.	548
284	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	115	45	0	CHIC.	548
285	SMITH, R.E. TESTAMENTARY TRUSTS/	I		24	100	25	0	CHIC.	0
286	SMITH, R.E. TESTAMENTARY TRUSTS/	I		20	100	-50	0	EVANG.	314
287	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	100	15	0	CHIC.	50
288	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	100	15	0	CHIC.	223
289	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	100	15	0	CHIC.	175
290	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	75	-65	0	EVANG.	258
291	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	75	-65	0	EVANG.	258
292	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	75	-70	0	EVANG.	208
293	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	75	-130	0	EVANG.	1,000
294	SMITH, R.E. TESTAMENTARY TRUSTS/	I		8	75	-65	0	EVANG.	486
295	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	75	-65	0	EVANG.	46
296	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	90	-200	0	EVANG.	161

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
297	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	90	-200	0	EVANG.	219
298	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	90	-170	0	EVANG.	72
299	SMITH, R.E. TESTAMENTARY TRUSTS/	I		6	115	45	0	CHIC.	45,000
300	SMITH, R.E. TESTAMENTARY TRUSTS/	I		20	115	45	438	CHIC.	45,000
301	SMITH, R.E. TESTAMENTARY TRUSTS/	I		24	75	-65	0	EVANG.	900
302	HOPMANN, WILFRED	I		14	115	45	420	CHIC.	101,250
303	MEYER, LLOYD J.	I		4	85	15	250	CHIC.	5,000
304	MORRISON, HEIRS OF IVY M.	I		19	115	45	898	CHIC.	270,000
305	F & W AGRICULTURAL INVEST. CORP.	I		20	70	15	1,082	CHIC.	162,000
306	STEPHEN FARMS	I		19	70	20	871	CHIC.	57,000
307	STEPHEN FARMS	I		19	115	45	705	CHIC.	133,000
308	STEPHEN FARMS	I		19	115	60	937	CHIC.	133,000
309	FT. BEND CO. M.U.D. 69	P	790253	20	75	-90	1,400	CHIC.	64,569
310	FRANZ, RAYMOND	I		18	115	50	583	CHIC.	82,000
311	FRANZ, RAYMOND	I		20	115	50	335	CHIC.	82,000
312	FRANZ, RAYMOND	I		14	115	50	326	CHIC.	82,000
313	FRANZ, RAYMOND	I		18	115	40	480	CHIC.	82,000
314	FRANZ, RAYMOND	I		18	115	50	300	CHIC.	82,000
315	CARDIFF BROTHERS	I		20	110	15	614	CHIC.	155,000
316	CARDIFF BROTHERS	I		20	115	25	530	CHIC.	170,000
317	CARDIFF BROTHERS	I		20	110	25	1,000	CHIC.	153,333
318	CARDIFF BROTHERS	I		20	110	25	1,000	CHIC.	153,333
319	CARDIFF BROTHERS	I		18	110	15	800	CHIC.	153,333
320	JORDAN FARMS, CHESTER	I		18	115	50	972	CHIC.	160,000
321	JORDAN FARMS, CHESTER	I		18	115	40	914	CHIC.	160,000
322	JORDAN FARMS, CHESTER	I		14	115	40	901	CHIC.	160,000
323	LEISSNER, ADELE	I		20	95	40	0	CHIC.	67,500
324	ANADRILL/SCHLUMBERGER	N		9	70	-200	1,097	EVANG.	10,570

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
325	BANKER BROS.	I		18	70	20	0	CHIC.	60,000
326	BOSSE CATTLE CO.	I		4	85	35	300	CHIC.	3,500
327	BOSSE CATTLE CO.	I		6	85	35	300	CHIC.	13,000
328	TWINWOOD FARMS	I		4	115	70	338	CHIC.	700
329	TWINWOOD FARMS	I		4	115	70	350	CHIC.	500
330	TWINWOOD FARMS	I		3	115	70	350	CHIC.	200
331	TWINWOOD FARMS	I		6	115	70	307	CHIC.	55,033
332	TWINWOOD FARMS	I		6	115	70	214	CHIC.	55,033
333	TWINWOOD FARMS	I		6	115	70	280	CHIC.	55,033
334	TWINWOOD FARMS	I		6	115	70	280	CHIC.	55,033
335	TWINWOOD FARMS	I		6	115	70	294	CHIC.	55,033
336	TWINWOOD FARMS	I		6	115	70	430	CHIC.	55,033
337	TWINWOOD FARMS	I		6	115	70	360	CHIC.	55,033
338	TWINWOOD FARMS	I		10	115	70	453	CHIC.	55,033
339	MAHLER, CHARLES F. II ET AL	I		2	100	25	160	CHIC.	95
340	MAHLER, CHARLES F. II ET AL	I		2	100	-65	210	EVANG.	95
341	WENDT FARMS, EAJL	I		2	95	45	0	CHIC.	100
342	WENDT, JACK	I		4	95	50	0	CHIC.	100
343	ORCHARD, CITY OF	P	790037	6	115	70	402	CHIC.	13,751
344	JORDAN FARMS, CHESTER	I		4	115	50	282	CHIC.	50
345	GOLF UNLIMITED, INC.	I		6	75	-130	300	EVANG.	1,000
346	DANKLEFS, CLARENCE	I		20	70	0	400	CHIC.	30,000
347	GLESS, CHARLES	I		20	65	-20	850	CHIC.	0
348	JUNGMAN ESTATE	I		24	65	-35	1,260	CHIC.	30,000
349	BEARD, ROBERT H.	S		2	65	-20	54	CHIC.	2
350	MCMILLIAN, DON	I		24	110	25	346	CHIC.	56,200
351	MCMILLIAN, DON	I		24	115	40	492	CHIC.	56,200
352	MCMILLIAN, DON	I		24	110	25	0	CHIC.	66,000

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
353	GENERAL HOMES	P		24	110	15	0	CHIC.	114,000
354	LEXINGTON DEVELOPMENT CO.	N		6	75	-40	500	CHIC.	0
355	GOLF UNLIMITED, INC.	I		10	75	-130	455	EVANG.	95,000
356	MAHLMANN, JOHN	I		14	65	-20	221	CHIC.	0
357	LAKE OLYMPIA CIVIC ASSOCIATION	P		8	70	-130	315	EVANG.	22,683
358	LAKE OLYMPIA CIVIC ASSOCIATION	P		6	70	-130	315	EVANG.	22,683
359	KENDLETON, CITY OF	P	790018	8	95	55	1,000	CHIC.	30,010
360	KENDLETON, CITY OF	P	790018	8	95	55	1,000	CHIC.	30,010
361	BEARD ESTATE, S.A.	I		24	65	-20	1,100	CHIC.	112,000
362	STERN, A.L.	I		2	95	40	90	CHIC.	55
363	HOUSTON LIGHTING & POWER CO.	N	790100	4	55	-50	350	CHIC.	42
364	HOUSTON LIGHTING & POWER CO.	N	790100	4	70	-165	350	EVANG.	42
365	SOMER, BETHEL V.	I		12	115	70	272	CHIC.	10,368
366	HINES NURSERIES, INC.	P		4	110	25	300	CHIC.	1,000
367	HINES NURSERIES, INC.	I		12	110	25	600	CHIC.	154,389
368	HINES NURSERIES, INC.	I		16	110	25	800	CHIC.	154,389
369	HOPMANN, URBAN C.	I		18	115	55	353	CHIC.	100,050
370	OWENS, JOEL H.	I		4	95	45	185	CHIC.	40
371	MOORE BROS.	I		20	70	10	900	CHIC.	225,000
372	MOORE TRUST, J.M. & H.G.	I		20	70	10	944	CHIC.	225,000
373	FROST, VERNON W.	I		4	115	70	120	CHIC.	200
374	FROST, VERNON W.	I		6	115	70	98	CHIC.	200
375	FROST, VERNON W.	I		4	115	70	207	CHIC.	200
376	GOOCH, JON DAVID	I		4	110	25	200	CHIC.	40
377	COOLEY, ENNIS M.	I		4	110	15	200	CHIC.	200
378	CHAMPION TECHNOLOGIES, INC.	N		2	65	-60	85	CHIC.	420
379	CHAMPION TECHNOLOGIES, INC.	N		6	65	-60	172	CHIC.	0
380	CHAMPION TECHNOLOGIES, INC.	N		6	65	-60	400	CHIC.	30

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
381	FORT BEND COUNTY CLUB	I		12	100	-55	500	EVANG.	30,000
382	TEXAS INDUSTRIES, INC.	N		12	90	-5	609	CHIC.	63,893
383	TEXAS INDUSTRIES, INC.	N		4	90	-5	347	CHIC.	1,764
384	LE BLANC, ORVILLE	I		4	75	-70	315	EVANG.	61
385	LE BLANC, ORVILLE	I		4	75	-65	240	EVANG.	192
386	TEXAS PARKS & WILDLIFE DEPT.	I	790223	4	65	-35	103	CHIC.	2,501
387	TEXAS PARKS & WILDLIFE DEPT.	I		4	65	-35	123	CHIC.	714
388	FARMERS GIN COMPANY OF ROSENBE	N		5	100	-20	0	EVANG.	200
389	MCNEILL, WADE	I		4	95	45	130	CHIC.	100
390	MCNEILL, WADE	I		4	70	40	130	CHIC.	100
391	MCNEILL, WADE	I		4	70	40	130	CHIC.	100
392	MOORE BROS.	I		4	70	15	120	CHIC.	100
393	MOORE BROS.	I		4	70	5	120	CHIC.	100
394	MOORE BROS.	I		4	70	5	120	CHIC.	100
395	MOORE BROS.	I		4	70	5	120	CHIC.	100
396	MOORE BROS.	I		4	70	10	135	CHIC.	100
397	MOORE BROS.	I		4	70	10	120	CHIC.	100
398	MOORE BROS.	I		4	70	15	120	CHIC.	100
399	MOORE BROS.	I		4	70	10	120	CHIC.	100
400	MOORE BROS.	I		4	115	45	130	CHIC.	100
401	MOORE BROS.	I		4	115	45	130	CHIC.	100
402	MOORE ESTATE, J.F.D.	I		4	115	60	130	CHIC.	100
403	MOORE ESTATE, J.F.D.	I		4	115	60	130	CHIC.	100
404	MOORE ESTATE, J.F.D.	I		4	115	60	130	CHIC.	100
405	MOORE ESTATE, J.F.D.	I		4	115	60	130	CHIC.	100
406	MOORE ESTATE, J.F.D.	I		4	115	60	130	CHIC.	100
407	MOORE ESTATE, J.F.D.	I		4	115	45	130	CHIC.	100
408	MOORE ESTATE, J.F.D.	I		4	115	60	130	CHIC.	100

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
409	MOORE ESTATE, J.F.D.	I		4	115	60	130	CHIC.	100
410	MORRISON, HEIRS OF IVY M.	I		4	115	45	130	CHIC.	100
411	MORRISON, HEIRS OF IVY M.	I		4	115	45	130	CHIC.	100
412	MORRISON, HEIRS OF IVY M.	I		4	115	60	130	CHIC.	100
413	MORRISON, HEIRS OF IVY M.	I		4	115	55	130	CHIC.	100
414	MORRISON, HEIRS OF IVY M.	I		4	115	55	130	CHIC.	100
415	MORRISON, HEIRS OF IVY M.	I		4	115	55	130	CHIC.	100
416	MORRISON, HEIRS OF IVY M.	I		4	115	70	130	CHIC.	100
417	MORRISON, HEIRS OF IVY M.	I		4	115	60	130	CHIC.	100
418	BRISCOE, MASON III	I		2	100	25	60	CHIC.	276
419	LEA, JERROLD P.	I		6	100	-65	150	EVANG.	250
420	WRIGHT, LEE B.	I		2	100	-50	110	EVANG.	291
421	GEORGE FOUNDATION	I		4	70	-15	200	CHIC.	1,920
422	GEORGE FOUNDATION	I		6	70	-15	80	CHIC.	96
423	GEORGE FOUNDATION	I		4	70	-15	400	CHIC.	3,360
424	GEORGE FOUNDATION	I		2	70	-15	80	CHIC.	96
425	GEORGE FOUNDATION	I		2	70	-15	80	CHIC.	96
426	GEORGE FOUNDATION	I		4	70	-50	222	CHIC.	27
427	GEORGE FOUNDATION	I		2	70	-50	170	CHIC.	27
428	GEORGE FOUNDATION	I		6	75	-60	180	EVANG.	420
429	GEORGE FOUNDATION	I		2	55	-20	85	CHIC.	204
430	GEORGE FOUNDATION	I		2	55	-20	85	CHIC.	204
431	GEORGE FOUNDATION	I		2	55	-20	85	CHIC.	204
432	GEORGE FOUNDATION	I		4	55	-20	200	CHIC.	2,040
433	GEORGE FOUNDATION	I		4	55	-20	180	CHIC.	2,040
434	GEORGE FOUNDATION	I		2	55	-20	85	CHIC.	204
435	GEORGE FOUNDATION	I		2	55	-25	80	CHIC.	96
436	GEORGE FOUNDATION	I		4	55	-50	140	CHIC.	300

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
437	GEORGE FOUNDATION	I		4	70	5	280	CHIC.	204
438	VALLEY LODGE INC.	I		6	115	70	183	CHIC.	54,000
439	VALLEY LODGE INC.	I		6	115	70	83	CHIC.	54,000
440	VALLEY LODGE INC.	I		4	115	70	350	CHIC.	500
441	FARRELL, DOROTHY	I		4	70	-165	115	EVANG.	952
442	SOUTHWEST RETAIL FISHING PROJECT	N		6	75	-60	52	EVANG.	333
443	SOUTHWEST RETAIL FISHING PROJECT	N		6	75	-60	52	EVANG.	333
444	SOUTHWEST RETAIL FISHING PROJECT	N		4	75	-60	234	EVANG.	333
445	BAY RIDGE CHRISTIAN COLLEGE	P		14	95	65	350	CHIC.	2,200
446	HOUSTON INTERNATIONAL TELEPORT	P		6	70	-175	80	EVANG.	300
447	FT. BEND CO. M.U.D. 106	P	790296	16	75	-40	1,942	CHIC.	51,589
448	NEWLAND TEXAS	P		12	75	-40	445	CHIC.	76,217
449	NEWLAND TEXAS	P		12	75	-40	440	CHIC.	76,217
450	BONO, B.P.	I		10	90	-150	0	EVANG.	7,000
451	FT. BEND CO. PRECINCT 3	P		5	90	-5	336	CHIC.	100
452	HUDSON PRODUCTS CORPORATION	N		6	95	50	1,200	CHIC.	42,000
453	LANDGRANT RESOURCES	I		2	65	-10	60	CHIC.	100
454	LANDGRANT RESOURCES	I		4	70	5	60	CHIC.	100
455	LANDGRANT RESOURCES	I		4	70	5	72	CHIC.	100
456	LANDGRANT RESOURCES	I		4	70	5	60	CHIC.	100
457	LANDGRANT RESOURCES	I		4	70	0	70	CHIC.	100
458	LANDGRANT RESOURCES	I		4	65	-10	55	CHIC.	100
459	LANDGRANT RESOURCES	I		20	65	-10	1,015	CHIC.	105,000
460	LANDGRANT RESOURCES	I		20	65	-10	520	CHIC.	105,000
461	TONDRE, A.A.	I		4	115	70	326	CHIC.	1,000
462	TONDRE, A.A.	I		8	115	70	580	CHIC.	1,000
463	NELSON, WAYNE	I		8	115	55	250	CHIC.	0
464	ALLEN, JAMES B.	I		12	115	55	300	CHIC.	0

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
465	LUDWIG, REUBEN	I		12	95	55	282	CHIC.	0
466	LUDWIG, REUBEN	I		2	95	55	100	CHIC.	250
467	FINKE INC., JONES G.	I		6	95	45	180	CHIC.	1,000
468	D & J WATER SUPPLY, INC.	N		6	55	-20	75	CHIC.	900
469	D & J WATER SUPPLY, INC.	N		5	55	-20	75	CHIC.	900
470	SMITH, R.E. TESTAMENTARY TRUSTS/	I		8	75	-40	0	CHIC.	486
471	SMITH, R.E. TESTAMENTARY TRUSTS/	I		8	75	-40	0	CHIC.	390
472	SMITH, R.E. TESTAMENTARY TRUSTS/	I		8	75	-40	0	CHIC.	365
473	SMITH, R.E. TESTAMENTARY TRUSTS/	I		4	115	45	0	CHIC.	200
474	ENSERCH GAS TRANSMISSION CO.	N		6	70	40	125	CHIC.	2
475	ENSERCH GAS TRANSMISSION CO.	N		4	70	40	225	CHIC.	2
476	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
477	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
478	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
479	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
480	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
481	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
482	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
483	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
484	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
485	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
486	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
487	HOUSTON HULL AIRPORT	P		4	75	-180	0	EVANG.	20
488	BRYNMAR LAKE ESTATES HOA	P		8	110	-70	0	EVANG.	43,200
489	ENGEL, LLOYD	I		12	95	55	300	CHIC.	6,000
490	FT. BEND CO. M.U.D. 13	P	790072	18	75	-90	1,115	CHIC.	420,499
491	FT. BEND TELEPHONE COMPANY	N		10	110	5	260	CHIC.	248
492	FT. BEND TELEPHONE COMPANY	N		2	65	-35	95	CHIC.	10

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
493	LAMAR C.I.S.D. - HUGGINS SCHOOL	P		6	115	40	193	CHIC.	4,000
494	LAMAR C.I.S.D. - MEYER SCHOOL	P		6	85	25	900	CHIC.	4,000
495	LAMAR C.I.S.D. - WILLIAMS SCHOOL	P		4	75	-60	666	EVANG.	4,000
496	SLACALEK, LEROY C.	I		6	65	-20	140	CHIC.	10,250
497	SLACALEK, LEROY C.	I		4	65	-20	140	CHIC.	10,250
498	WESSENDORFF CATTLE CO.	I		4	75	-65	0	EVANG.	103
499	WESSENDORFF CATTLE CO.	I		4	75	-65	0	EVANG.	162
500	WESSENDORFF CATTLE CO.	I		4	110	-70	0	EVANG.	92
501	WESSENDORFF CATTLE CO.	I		4	100	-50	0	EVANG.	92
502	GRIMES INC., CALLIER	I		4	70	10	127	CHIC.	9,167
503	GRIMES INC., CALLIER	I		4	70	10	140	CHIC.	9,167
504	GRIMES INC., CALLIER	I		4	70	10	176	CHIC.	9,167
505	CLUB AT FALCON POINT, THE	P		12	110	5	600	CHIC.	65,000
506	ENGEL, ALAN D.	I		12	95	50	284	CHIC.	11,000
507	HARRISON INTERESTS, LTD.	I		4	110	25	150	CHIC.	100
508	HARRISON INTERESTS, LTD.	I		4	110	25	175	CHIC.	100
509	HARRISON INTERESTS, LTD.	I		4	110	25	150	CHIC.	100
510	HARRISON INTERESTS, LTD.	I		4	110	25	175	CHIC.	100
511	HARRISON INTERESTS, LTD.	I		12	110	25	538	CHIC.	4,500
512	HARRISON INTERESTS, LTD.	I		4	115	45	200	CHIC.	100
513	HARRISON INTERESTS, LTD.	I		4	110	25	215	CHIC.	100
514	HARRISON INTERESTS, LTD.	I		4	115	45	174	CHIC.	100
515	HARRISON INTERESTS, LTD.	I		6	110	25	200	CHIC.	1,000
516	HARRISON INTERESTS, LTD.	I		4	100	30	150	CHIC.	100
517	HARRISON INTERESTS, LTD.	I		4	110	25	150	CHIC.	100
518	HARRISON, DAN & BRUCE	I		4	110	-70	200	EVANG.	100
519	KRENEK, BESSIE	I		2	85	25	80	CHIC.	100
520	KRENEK, BESSIE	I		2	85	25	120	CHIC.	100

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
521	KRENEK, DAN A.	I		2	85	25	40	CHIC.	200
522	LONGSERRE, G.W.	I		2	55	-50	100	CHIC.	100
523	LUDWIG, HARVEY	I		4	95	45	0	CHIC.	,500
524	MYSKA, EUGENE E.	I		4	85	35	105	CHIC.	100
525	MYSKA, EUGENE E.	I		2	115	45	100	CHIC.	100
526	VALLET, WILLIE	I		16	95	45	0	CHIC.	10,800
527	VIKTORIN, LARRY	I		5	70	35	0	CHIC.	13,750
528	VIKTORIN, LARRY	I		4	70	35	0	CHIC.	13,750
529	WENDT, JACK	I		2	95	50	0	CHIC.	100
530	WENDT, JACK	I		2	95	45	0	CHIC.	100
531	WENDT, JACK	I		2	95	45	0	CHIC.	100
532	WENDT, JACK	I		2	95	45	0	CHIC.	100
533	WENDT, JACK	I		2	70	40	0	CHIC.	100
534	WENDT, JACK	I		2	70	35	0	CHIC.	100
535	WINKLEMANN TRUSTEE, SAM	I		6	95	40	0	CHIC.	38,500
536	WINKLEMANN TRUSTEE, SAM	I		6	95	40	0	CHIC.	38,500
537	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790085	10	75	-70	336	EVANG.	56,833
538	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790085	12	75	-70	1,040	EVANG.	56,833
539	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790085	11	75	-130	632	EVANG.	56,833
540	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790085	9	75	-180	702	EVANG.	34,433
541	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790084	9	75	-180	406	EVANG.	34,433
542	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790084	10	75	-180	407	EVANG.	34,433
543	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790084	6	90	-150	85	EVANG.	100
544	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790084	6	90	-150	85	EVANG.	100
545	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790084	6	90	-150	85	EVANG.	100
546	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790084	6	90	-150	85	EVANG.	100
547	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790085	6	75	-70	85	EVANG.	100
548	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790085	8	75	-130	90	EVANG.	3,600

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
549	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790085	8	75	-180	90	EVANG.	3,600
550	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790085	8	75	-90	90	CHIC.	100
551	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790084	6	70	-165	95	EVANG.	100
552	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790084	2	75	-40	60	CHIC.	100
553	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790084	4	90	-150	85	EVANG.	100
554	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790084	2	75	-90	85	CHIC.	100
555	BOWNDS, WILLIAM A. JR.	I		5	75	-130	510	EVANG.	0
556	BROOKS,MOON,OXNERS,VICKERS et al	I		6	100	30	325	CHIC.	10,000
557	FLOWERS, ELMER	I		4	55	-50	0	CHIC.	200
558	FREUND, JAMES	I		2	70	20	101	CHIC.	200
559	FREUND, JAMES	I		4	70	20	110	CHIC.	2,000
560	GIBSON, JERRY	I		10	95	65	285	CHIC.	6,500
561	GRAND MISSION WEST	P		10	90	-5	0	CHIC.	0
562	JARDIN DE LAS PALMAS	I		6	100	-65	0	EVANG.	5,000
563	JARDIN DE LAS PALMAS	I		4	100	-65	200	EVANG.	5,000
564	GLS GRASS FARMS	I		4	85	15	110	CHIC.	5,500
565	GLS GRASS FARMS	I		4	85	15	110	CHIC.	5,500
566	GLS GRASS FARMS	I		4	85	15	110	CHIC.	5,500
567	FREUND, JAMES & SON	I		4	70	35	120	CHIC.	0
568	FREUND, JAMES & SON	I		4	70	20	0	CHIC.	0
569	FREUND, RAYMOND	I		4	70	20	110	CHIC.	0
570	FT. BEND CO. PRECINCT 1	P		4	75	-40	336	CHIC.	200
571	CALDWELL NURSERY	I		4	85	25	140	CHIC.	2,000
572	MEYER, GILBER L.	I		8	85	35	282	CHIC.	3,200
573	MORGAN, FLETCHER JR.	I		2	55	-20	0	CHIC.	100
574	MORGAN, FLETCHER JR.	I		2	100	-40	160	EVANG.	100
575	MORGAN, FLETCHER JR.	I		2	55	-35	260	CHIC.	100
576	MYSKA, CLIFFORD E.	I		4	95	55	0	CHIC.	1,000

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
577	MYSKA, CLIFFORD E.	I		4	115	45	0	CHIC.	1,000
578	MYSKA, CLIFFORD E.	I		3	95	45	0	CHIC.	200
579	PALMS NURSERY #12	I		4	70	-130	200	EVANG.	0
580	PROVIDENT NATIONAL INSURANCE C	P		8	75	-90	400	CHIC.	45,000
581	SCHULTZ INC., A.G. SR. & SONS	I		6	70	0	175	CHIC.	8,250
582	SCHULTZ INC., A.G. SR. & SONS	I		4	70	0	105	CHIC.	8,250
583	SCHULTZ INC., A.G. SR. & SONS	I		4	70	0	105	CHIC.	100
584	SCHULTZ INC., A.G. SR. & SONS	I		4	70	0	105	CHIC.	0
585	SCHULTZ INC., A.G. SR. & SONS	I		4	70	0	105	CHIC.	0
586	SCHULTZ BROS. INC.	I		4	70	0	115	CHIC.	1,000
587	SCHULTZ, MRS. ARNO G.	I		2	70	0	100	CHIC.	100
588	SOLOMON, JIMMIE	I		4	55	-50	200	CHIC.	1,000
589	STELLA RANCH	I		10	110	25	0	CHIC.	270,000
590	SUGAR MILL COMMUNITY ASSOCIATIO	P		8	75	-180	550	EVANG.	45,000
591	SUGARLAND PROPERTIES, INC.	P		8	70	-150	530	EVANG.	0
592	SUGARLAND PROPERTIES, INC.	P		8	75	-90	530	CHIC.	0
593	SUGARLAND PROPERTIES, INC.	P		5	70	-150	525	EVANG.	0
594	SUGARLAND PROPERTIES, INC.	P		5	70	-200	460	EVANG.	0
595	SWEETWATER COUNTRY CLUB	P		12	70	-150	530	EVANG.	0
596	SWEETWATER COUNTRY CLUB	P		8	70	-150	525	EVANG.	0
597	SWEETWATER COUNTRY CLUB	P		8	70	-150	525	EVANG.	0
598	SWEETWATER COUNTRY CLUB	P		4	70	-150	525	EVANG.	0
599	WADE, CHARLES A.	I		4	100	30	185	CHIC.	200
600	WESSENDORFF CATTLE CO.	I		4	110	15	0	CHIC.	100
601	ZATOPEK, MARK	I		2	70	20	100	CHIC.	100
602	ZATOPEK, MARK	I		4	70	20	100	CHIC.	500
603	ZATOPEK, MARK	I		2	70	20	100	CHIC.	100
604	RICHMOND IRRIGATION CO.	I		4	75	-60	200	EVANG.	0

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
605	WEATHERFORD FARMS & GREENHOU	I		6	70	-225	377	EVANG.	0
606	B S S HINDU TEMPLE	P		6	70	-225	350	EVANG.	0
607	HOUSTON LIGHTING & POWER COMPA	N	790100	4	55	-50	300	CHIC.	0
608	FIRST COLONY COMM. SER. ASSOC.	P		10	70	-150	525	EVANG.	0
609	FIRST COLONY COMM. SER. ASSOC.	P		10	70	-165	550	EVANG.	0
610	GEORGE FOUNDATION	I		2	70	-15	80	CHIC.	0
611	DANKLEFS, CLARENCE	I		6	65	-20	330	CHIC.	0
612	MAHLMANN ESTATE	I		12	85	15	285	CHIC.	16,900
613	PATTERSON, A.E. II	I		4	95	55	100	CHIC.	0
614	PATTERSON, A.E. II	I		2	95	55	110	CHIC.	0
615	PLAY BALL, INC.	P		4	110	5	0	CHIC.	0
616	PLAY BALL, INC.	P		4	110	5	0	CHIC.	0
617	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790085	6	75	-70	361	EVANG.	0
618	TEXAS DEPT. CRIMINAL JUSTICE-ID	P	790085	8	90	-150	90	EVANG.	0
619	THOMPSONS, TOWN OF	P		4	55	-50	260	CHIC.	0
620	THOMPSONS, TOWN OF	P		4	55	-50	260	CHIC.	0
621	KRAMR BROS.	I		10	95	65	574	CHIC.	0
622	KUCERA, SIMON	I		8	95	65	304	CHIC.	0
623	ALBRIGHT, RALPH	I		2	70	5	80	CHIC.	0
624	FROST, J.M. III	I		4	70	-115	200	EVANG.	0
625	FROST, J.M. III	I		4	70	-115	200	EVANG.	0
626	FROST, J.M. III	I		4	70	-225	225	EVANG.	0
627	FROST, J.M. III	I		4	70	-165	200	EVANG.	0
628	FROST, J.M. III	I		4	70	-165	200	EVANG.	0
629	MEYER, CLARENCE C.	I		3	65	-35	0	CHIC.	0
630	MEYER, CLARENCE C.	I		3	65	-35	0	CHIC.	0
631	THORP, JOE L.	I		4	115	70	100	CHIC.	0
632	DILLARD, KEVIN L.	I		4	100	-65	150	EVANG.	0

TABLE IV-2 PERMITTED WATER WELLS IN FORT BEND COUNTY (continued)

WELL NO.	OWNER	WATER USE (1)	TDH SYSTEM ID	DIAM. OF INNER CASING (INCHES)	GROUND ELEV. (FEET)	1987 WATER ELEV. (FEET)	TOTAL WELL DEPTH (FEET)	PRODUCING AQUIFER	GALLONS PUMPED IN 1990 (1000 GAL.)
633	HINSLEY, GEORGE R.	I		4	100	-50	150	EVANG.	0
634	NEW TERRITORY RESID. COMM.ASSOC.	P		6	75	-40	500	CHIC.	0
635	NEW TERRITORY RESID. COMM.ASSOC.	P		6	100	-65	500	EVANG.	0
636	BAY RIDGE CHRISTIAN COLLEGE	P		4	95	65	150	CHIC.	0
637	BAY RIDGE CHRISTIAN COLLEGE	P		4	95	65	150	CHIC.	0
638	BROWNING FERRIS INCORPORATED	N		6	65	-60	500	CHIC.	0
639	ROBERTS, GARY & DANNY	I		16	95	55	557	CHIC.	0
640	ROBERTS, GARY & DANNY	I		14	95	65	527	CHIC.	0
641	DUNCAN, KATHY	I		12	95	55	360	CHIC.	0
642	SUGAR LAND, CITY OF	P	790005	20	70	-200	1,100	EVANG.	0
643	SUGAR LAND, CITY OF	P	790005	20	70	-200	1,100	EVANG.	0
644	BEARD ESTATE, S.A.	I		2	65	-10	100	CHIC.	0
645	BEARD ESTATE, S.A.	I		2	65	-10	100	CHIC.	0
646	BEARD ESTATE, S.A.	I		4	65	-20	100	CHIC.	0

NOTE:								TOTAL (1000 GALLON)	22,837,030
(1) Abbreviations: P - Public supply, N - Industrial, I - Irrigation								TOTAL (ACRE-FEET)	70,089

SOURCE: FORT BEND SUBSIDENCE DISTRICT

TABLE IV-3 WATER SUPPLY ENTITIES IN FORT BEND COUNTY

TDH USER ID	SYSTEM NAME	POP. SERVED	NO. OF SERVIC CONN.	TOTAL PROD. (1000 GPD)	AVG. DAILY CONSUMP. (1000 GPD)	TOTAL STOR. (1000 GAL.)	ELEV. STOR. (1000 GAL.)	BOOSTER PUMP CAPACITY (1000 GPD)	AUX. PROD. CAPACITY (1000 GPD)	NO. OF WELLS
790309	5TH STREET WATER CORPORATION	598	196	0	0	0	0	0	0	1
790014	BEASLEY CITY OF	576	215	792	50	65	50	864	720	1
790051	BLUE RIDGE WEST MUD	6,500	2,152	3,312	700	950	500	6,480	3,312	2
790274	CINCO MUD NO 1	288	0	2,145	153	1,865	0	5,803	0	1
790306	CINCO MUD NO 2	300	130	0	0	0	0	0	0	0
790292	CINCO MUD NO 3	123	47	0	0	0	0	0	0	0
790291	CINCO MUD NO 5	186	62	0	0	0	0	0	0	0
790307	CINCO MUD NO 9	150	50	0	0	0	0	0	0	0
790159	FIRST COLONY MUD NO 1	4,131	1,377	0	326	0	0	0	0	0
790240	FIRST COLONY MUD NO 2	1,000	19	0	27	0	0	0	0	0
790272	FIRST COLONY MUD NO 3	1,698	566	0	256	0	0	0	0	0
790157	FIRST COLONY MUD NO 4	1,851	617	0	297	0	0	0	0	0
790239	FIRST COLONY MUD NO 5	882	294	0	164	0	0	0	0	0
790175	FIRST COLONY MUD NO 6	2,916	972	0	373	0	0	0	0	0
790228	FIRST COLONY MUD NO 8	1,248	416	0	188	0	0	0	0	0
790230	FIRST COLONY MUD NO 9	1,905	635	3,168	403	450	0	5,040	2,880	1
790297	FT BEND COUNTY MUD NO 108	942	314	0	0	0	0	0	0	0
790298	FT BEND COUNTY MUD NO 109	390	130	0	0	0	0	0	0	0
790071	FT BEND COUNTY MUD NO 12	7,380	2,460	0	1,043	0	0	0	0	0
790072	FT BEND COUNTY MUD NO 13	20,166	6,722	10,440	2,671	5,840	2,000	13,680	3,168	3
790093	FT BEND COUNTY MUD NO 16	4,410	1,470	0	572	0	0	0	0	0
790155	FT BEND COUNTY MUD NO 19	426	142	0	0	0	0	0	0	0
790038	FT BEND COUNTY MUD NO 2	5,700	1,910	3,132	686	429	0	3,427	1,152	2
790237	FT BEND COUNTY MUD NO 23	100	33	1,944	13	500	0	4,550	1,901	1
790130	FT BEND COUNTY MUD NO 25	1,989	669	1,944	205	420	0	2,160	1,080	2
790137	FT BEND COUNTY MUD NO 26	2,277	759	1,656	252	500	0	2,880	1,620	2
790146	FT BEND COUNTY MUD NO 30	2,244	748	1,440	273	210	0	2,160	1,555	1
790200	FT BEND COUNTY MUD NO 34	483	161	2,592	63	300	0	2,880	2,808	1

TABLE IV-3 WATER SUPPLY ENTITIES IN FORT BEND COUNTY (continued)

TDH USER ID	SYSTEM NAME	POP. SERVED	NO. OF SERVIC CONN.	TOTAL PROD. (1000 GPD)	AVG. DAILY CONSUMP. (1000 GPD)	TOTAL STOR. (1000 GAL.)	ELEV. STOR. (1000 GAL.)	BOOSTER PUMP CAPACITY (1000 GPD)	AUX. PROD. CAPACITY (1000 GPD)	NO. OF WELLS
790189	FT BEND COUNTY MUD NO 37	618	212	2,304	121	250	0	1,152	0	1
790229	FT BEND COUNTY MUD NO 41	444	255	1,368	57	333	0	2,160	1,512	1
790254	FT BEND COUNTY MUD NO 42	1,020	340	2,232	158	340	0	1,440	2,304	1
790220	FT BEND COUNTY MUD NO 47	600	200	0	0	0	0	0	0	1
790267	FT BEND COUNTY MUD NO 48	384	128	0	0	0	0	0	0	0
790256	FT BEND COUNTY MUD NO 49	282	94	0	0	0	0	0	0	0
790277	FT BEND COUNTY MUD NO 50	60	18	2,232	0	500	0	2,160	0	1
790310	FT BEND COUNTY MUD NO 60	993	2	1,180	168	224	0	1,728	1,180	1
790252	FT BEND COUNTY MUD NO 67	1,422	474	0	63	0	0	0	0	0
790262	FT BEND COUNTY MUD NO 68	33	11	0	3	0	0	0	0	0
790253	FT BEND COUNTY MUD NO 69	207	69	2,268	0	350	0	2,520	0	1
790268	FT BEND COUNTY MUD NO 81	636	212	2,016	208	144	0	1,224	1,548	2
790004	FT BEND WCID NO 2	11,568	3,856	8,121	3,030	3,300	1,000	12,960	2,304	5
790216	HARRIS-FT BEND COUNTY MUD NO 1	57	18	0	815	0	0	0	0	0
790100	HL&P - PARISH COAL PLANT	550	67	3,010	0	300	0	3,240	3,240	3
790144	HORSESHOE BEND VILLAGE	291	97	202	0	31	0	1,065	0	3
790018	KENDLETON CITY OF	546	190	288	0	94	50	864	0	1
790158	KINGSBRIDGE MUNICIPAL UTIL DIST	3,450	1,150	2,736	523	507	0	5,472	0	1
790002	LATERNA VILLA SUBDIVISION	351	117	173	0	0	0	0	0	1
790049	MEADOWCREEK MUNICIPAL UTIL DI	1,998	673	1,000	317	300	0	4,320	1,177	1
790025	MEADOWS MUNICIPAL UTIL DIST	5,500	1,464	3,154	676	560	0	3,600	1,569	2
790001	NEEDVILLE CITY OF	2,352	784	799	198	360	150	1,440	396	2
790174	NORTH MISSION GLEN MUD	1,434	478	1,080	147	250	0	4,104	1,080	1
790037	ORCHARD CITY OF	420	149	194	69	44	0	576	0	1
790199	PALMER PLANTATION MUD NO 1	975	325	2,232	1,550	420	0	2,160	0	1
790132	PECAN GROVE MUD NO 1	9,183	3,061	5,616	1,506	2,736	500	16,099	2,160	4
790112	PLANTATION MUNICIPAL UTIL DIST	3,120	1,040	2,577	205	336	0	3,672	2,160	2
790028	QUAIL VALLEY UTILITY DISTRICT	10,227	3,489	5,644	1,664	3,220	500	15,840	5,285	3

TABLE IV-3 WATER SUPPLY ENTITIES IN FORT BEND COUNTY (continued)

TDH USER ID	SYSTEM NAME	POP. SERVED	NO. OF SERVIC CONN.	TOTAL PROD. (1000 GPD)	AVG. DAILY CONSUMP. (1000 GPD)	TOTAL STOR. (1000 GAL.)	ELEV. STOR. (1000 GAL.)	BOOSTER PUMP CAPACITY (1000 GPD)	AUX. PROD. CAPACITY (1000 GPD)	NO. OF WELLS
790023	RICHMOND CITY OF	9,669	3,369	4,377	1,849	1,900	735	4,968	1,800	4
790003	ROSEBERG CITY OF	20,183	8,382	5,112	2,644	3,850	1,850	6,912	3,990	5
790005	SUGARLAND CITY OF	19,800	6,984	11,635	4,186	7,050	2,250	17,582	6,422	7
790084	TDCJ - CENTRAL UNIT	1,200	92	900	264	600	100	1,656	108	3
790085	TDCJ - JESTER UNITS	2,001	667	1,350	542	310	100	1,440	835	3
790033	THUNDERBIRD UTILITY DISTRICT N	3,672	1,224	2,988	768	940	0	6,624	1,238	2
790050	THUNDERBIRD UTILITY DISTRICT N	1,680	560	994	244	500	0	2,808	1,008	1
790223	TX PARKS & WILDLIFE - BRAZOS BD	250	175	86	0	63	0	288	0	1
	TOTALS =	188,035	63,692	110,433	30,690	41,341	9,785	179,998	61,512	84

Source: Texas Department of Health 12/91

TABLE IV-4 - FORT BEND COUNTY UTILITY DISTRICTS

ID NUMBERS ON EXHIBIT IV-2	UTILITY DISTRICT
1	Bellfort Mud
2	FBC MUD 67
3	FBC MUD 69
4	FBC MUD 71
5	FBC MUD 77
6	FBC MUD 5
7	FBC MUD 73
8	FBC MUD 51
9	FBC MUD 25
10	FBC MUD 52
11	FBC MUD 74
12	H-FBC MUD 3
13	H-FBC MUD 4
14	Willow Point
15	H-FBC MUD 1
16	FBC MUD 37
17	H-FBC MUD 5
18	Cornerstones MUD
19	Cinco MUD 9
20	FBC MUD 53
21	Cinco MUD 10
22	FBC MUD 37
23	Cinco MUD 2
24	Cinco MUD 6
25	Cinco MUD 3
26	Cinco MUD 12
27	Cinco MUD 11
28	FBC MUD 58
29	Cinco MUD 5
30	FBC MUD 70
31	Cinco MUD 1
32	Cinco MUD 14
33	FBC MUD 57
34	Cinco MUD 13
35	Cinco MUD 4
36	Via Ranch MUD 2
37	Cinco MUD 7
38	FBC MUD 35
39	Via Ranch MUD 4
40	Via Ranch MUD 2

TABLE IV-4 - FORT BEND COUNTY UTILITY DISTRICTS

ID NUMBERS ON EXHIBIT IV-2	UTILITY DISTRICT
41	FBC MUD 99
42	Via Ranch MUD 1
43	Cinco MUD 8
44	Via Ranch MUD 3
45	FBC MUD 34
46	Chelford City MUD
47	FBC MUD 44
48	Big Oaks MUD
49	FBC MUD 93
50	Mission Bend MUD 1
51	Cinco MUD 8
52	Grand Mission MUD 1
53	FBC LID 12
54	FBC MUD 105
55	FBC MUD 91
56	FBC LID 12
57	FBC MUD 30
58	FBC LID 12
59	FBC MUD 50
60	North Mission Glen MUD
61	Kingsbridge MUD
62	Renn Road MUD
63	South Mission Glen MUD
64	FBC MUD 81
65	FBC MUD 2
66	Twinwood MUD
67	FBC WCID 1
68	FBC WCID 1
69	Eldridge Road MUD
70	Meadows MUD
71	Eldridge Road MUD
72	FBC WCID 1
73	Burney Road MUD
74	FBC MUD 21
75	Eldridge Road MUD
76	Burney Road MUD
77	FBC MUD 41
78	FBC WCID 2
79	Pecan Grove MUD 1
80	FBC MUD 28
81	City of Cities MUD

TABLE IV-4 - FORT BEND COUNTY UTILITY DISTRICTS

ID NUMBERS ON EXHIBIT IV-2	UTILITY DISTRICT
82	FBC LID 3
83	FBC MUD 27
84	First Colony MUD 7
85	FBC MUD 20
86	FBC MUD 9
87	Blue Ridge West MUD
90	First Colony MUD 9
91	FBC MUD 16
92	First Colony MUD 8
93	FBC MUD 26
94	FBC MUD 42
95	First Colony MUD 2
96	FBC MUD 68
97	FBC MUD 13
98	FBC MUD 12
99	Post Oak Road MUD
100	FBC MUD 36
101	First Colony MUD 6
102	Meadowcreek MUD
104	First Colony MUD 1
105	Quail Valley MUD
106	First Colony MUD 5
108	First Colony MUD 4
109	First Colony MUD 4
110	Thunderbird ID
111	FBC MUD 19
112	FBC MUD 104
113	FBC MUD 1
114	FBC MUD 46
115	FBC MUD 103
116	First Colony MUD 3
117	FBC MUD 106
118	FBC MUD 101
119	FBC MUD 107
120	FBC MUD 108
121	FBC MUD 102
122	FBC MUD 109
123	FBC MUD 94
124	FBC MUD 31
125	Plantation MUD
126	FBC MUD 23

TABLE IV-4 - FORT BEND COUNTY UTILITY DISTRICTS

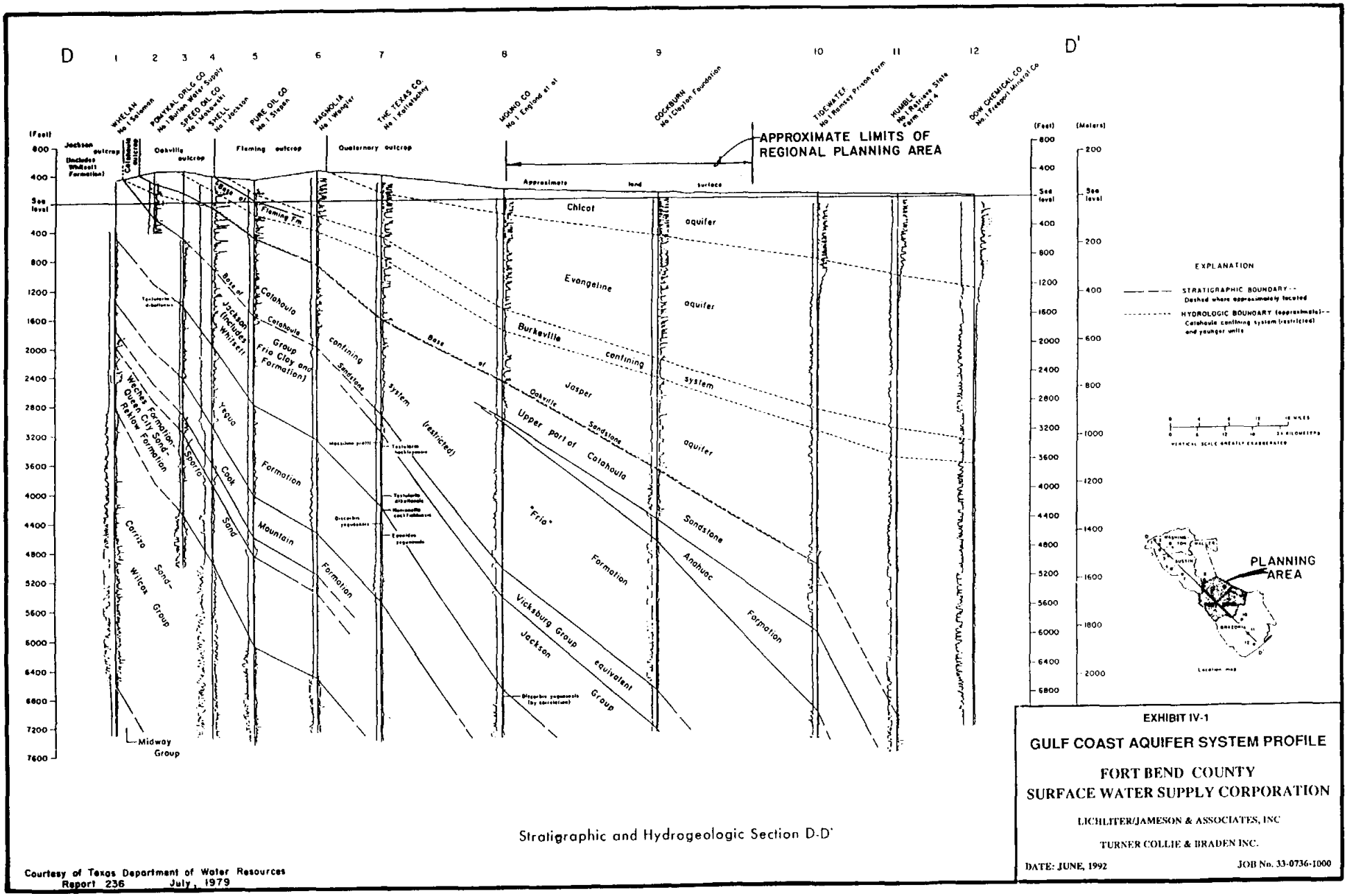
ID NUMBERS ON EXHIBIT IV-2	UTILITY DISTRICT
127	FBC MUD 56
128	FBC MUD 55
130	FBC MUD 66
131	FBC MUD 59
132	FBC MUD 54
133	FBC MUD 65
134	FBC MUD 63
135	Sienna Plantation LID
136	FBC MUD 79
137	Sienna Plantation MUD
138	Sienna Plantation FWSD
139	FBC MUD 45
140	Palmer Plantation MUD 1
141	Palmer Plantation MUD 2
142	FBC MUD 24
143	FBC MUD 47
144	FBC MUD 45
145	FBC MUD 49
146	FBC MUD 48
147	FBC MUD 60

TABLE IV-5 REPRESENTATIVE MONTHLY WATER CONSUMPTION IN FORT BEND COUNTY, TEXAS 1991

District	Total Connections	Commercial Connections	Average Daily Water Use (1000 gpd	Peak Daily Water Use (1000 gpd)	Average Monthly Residential Water Bill (3)	Average Cost per 1000 gal
Big Oaks	1	1	3	336	$13.98	$1.02
Chelford City MUD	2,787	31	1,234	2,411	$13.10	$0.96
First Colony MUD #1	1,374	33	385	See FB #13	$19.65	$1.44
First Colony MUD #2	16	16	27	See FB #13	$19.30	$1.41
First Colony MUD #3	655	32	296	See FB #13	$19.33	$1.42
First Colony MUD #4	635	55	442	See FB #13	$20.33	$1.49
First Colony MUD #5	438	21	207	See FB #13	$22.28	$1.63
First Colony MUD #6	1,010	29	418	See FB #13	$17.01	$1.25
First Colony MUD #8	481	20	185	See FB #13	$23.15	$1.70
First Colony MUD #9	798	22	281	545	$19.24	$1.41
Fort Bend MUD #12	2,468	121	1,076	See FB #13	$19.28	$1.41
Fort Bend MUD #13 (1)	15	11	4,424	7,180	$17.01	$1.25
Fort Bend MUD #19	142	0	30	38	$35.11	$2.57
Fort Bend MUD #25	698	2	282	937	$27.80	$2.04
Fort Bend MUD #30	823	8	303	470	$17.74	$1.30
Fort Bend MUD #34	162	2	53	337	$16.60	$1.22
Fort Bend MUD #41	368	2	91	251	$17.15	$1.26
Fort Bend MUD #67	541	25	201	See FB #69	$15.48	$1.13
Fort Bend MUD #68	50	2	4	See FB #69	$15.48	$1.13
Fort Bend MUD #69 (2)	182	10	460	1,010	$15.48	$1.13
Fort Bend MUD #81	254	15	159	372	$13.42	$0.98
Grand Mission MUD	1	0	7	612	$10.74	$0.79
Kingsbridge MUD	1,180	33	423	2,317	$20.39	$1.49
Mission Bend MUD #1	1,686	59	796	1,803	$13.90	$1.02
North Mission Glen MUD	482	2	146	228	$26.48	$1.94
Pecan Grove MUD	3,186	32	1,463	2,376	$14.35	$1.05
Total =	20,433	584	13,396	21,223	$18.61	$1.36

Notes:
(1) Includes First Colony MUD #'s 1-8 & Fort Bend MUD #12.
(2) Includes Fort Bend MUD #'s 67 & 68.
(3) Assumes an average consumption of 13,650 gallons per connection per month.

Source: Eco Resources



Stratigraphic and Hydrogeologic Section D-D'

Courtesy of Texas Department of Water Resources
Report 236 July, 1979

EXHIBIT IV-1

GULF COAST AQUIFER SYSTEM PROFILE

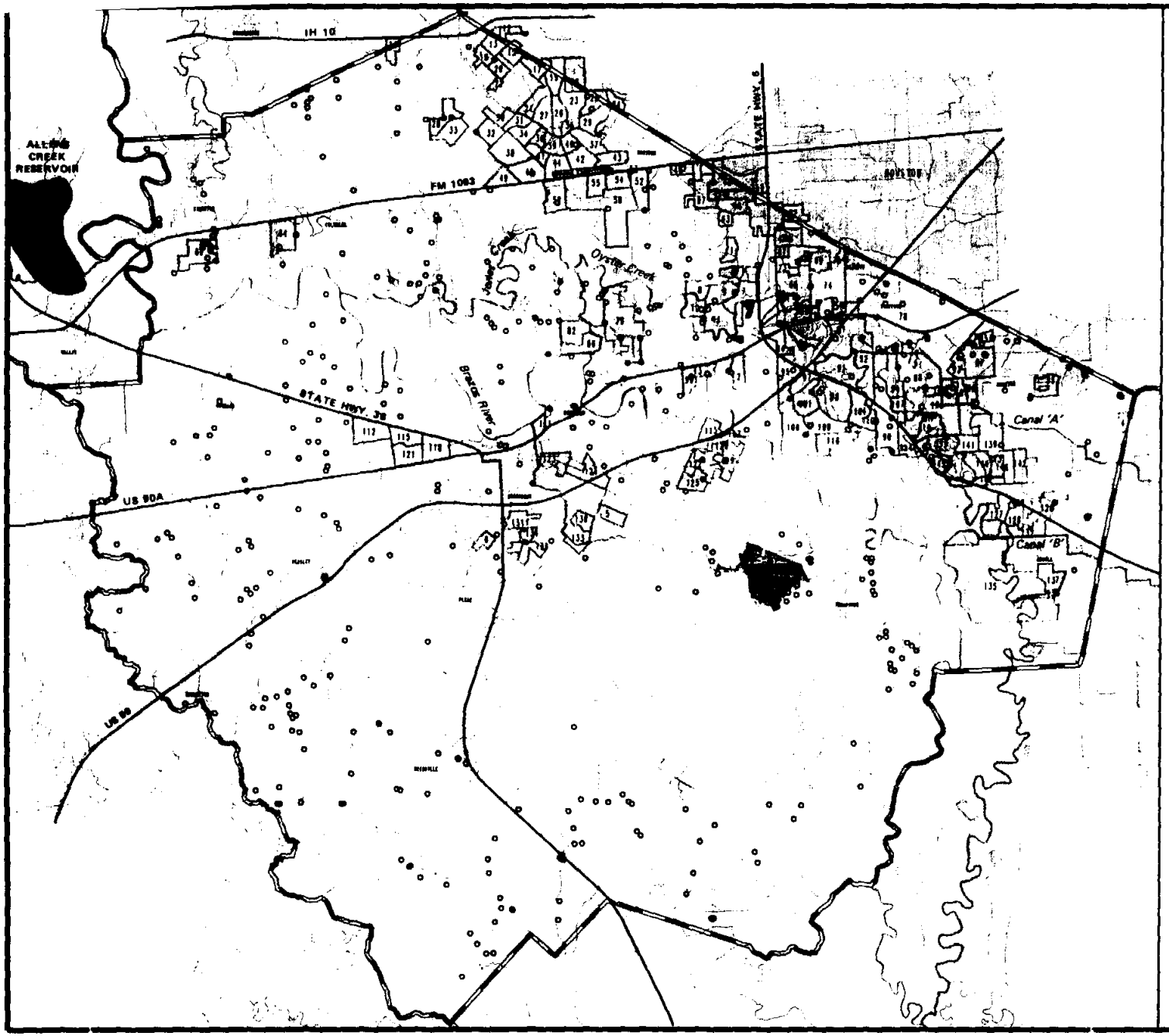
FORT BEND COUNTY SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC

TURNER COLLIE & BRADEN INC.

DATE: JUNE, 1992

JOB No. 33-0736-1000



KEY TO BASE MAP

Utility District Boundary

UD Reference Number (APPENDIX

County Line

Water Features

WELLS CLASSIFICATION

- Public Supply
- Industrial
- Irrigation

3.5 0 3.5

Scale in Miles

EXHIBIT IV-2

WATER SOURCES AND WATER ENTITIES

FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: JUNE 1992 JOB NO. 33-0736-100

SECTION V - PROJECTIONS OF WATER USE

GENERAL

Water use in Fort Bend County expanded significantly between 1972-1992 and is expected to continue increasing with projected population growth in the county. The increase in water demand since the 1970s has been due primarily to population growth in the northeast area of the county. Water demand projections are based on projected population and land use. Planned development and growth along transportation corridors are key factors in determining future land use. Water conservation plans are incorporated into demand calculations. The 1990 census data and 1990 recorded groundwater pumpage are used as the starting point in projections to achieve accurate projections of population and water demand.

EXISTING POPULATION

The 1990 census year was selected as the basis for population projections because it represents the most current official estimate of population distribution. The 1990 census indicates 225,421 persons resided in Fort Bend County, up 72 percent from 130, 846 persons in 1980. The majority of the growth in Fort Bend County has been in the northeastern corner which borders the City of Houston. Highway 59, Highway 90-A and Highway 6 have been the major transportation corridors along which growth has occurred. 63% of the county's population, or 142,946 people, live in the northeast area of the county. This area is approximately 16% of the total acreage in Fort Bend County.

EXISTING LAND USE

The existing land use map, Exhibit V-1, was derived from aerial photography and updated by using the Fort Bend County/Southwest Houston Economic Development Map dated April, 1991. The land-use coverage was examined with respect to municipal utility district (MUD) boundaries, city-limit delineations, and other pertinent political boundaries, such as census tract boundaries which also were input into the graphic model. Political boundaries shown on Exhibit V-1 were obtained from USGS mapping, TxDOT maps, and mapping provided by the Texas Water Commission.

population in census tracts was cumulated into demand areas. Water demand was estimated by comparing existing water meter records to existing connections. Projections in demand were made by extrapolating the demand per equivalent connection multiplied by the projected number of connections. A comparison of projected water demand to actual water demand in 1990 indicated that the projected demand in the City of Houston was significantly higher than actually experienced. An adjustment to the projected demand was made by shifting the rate of growth in demand by five years. That is, the water demand originally projected for 1990 was now assumed to occur in 1995, and so on.

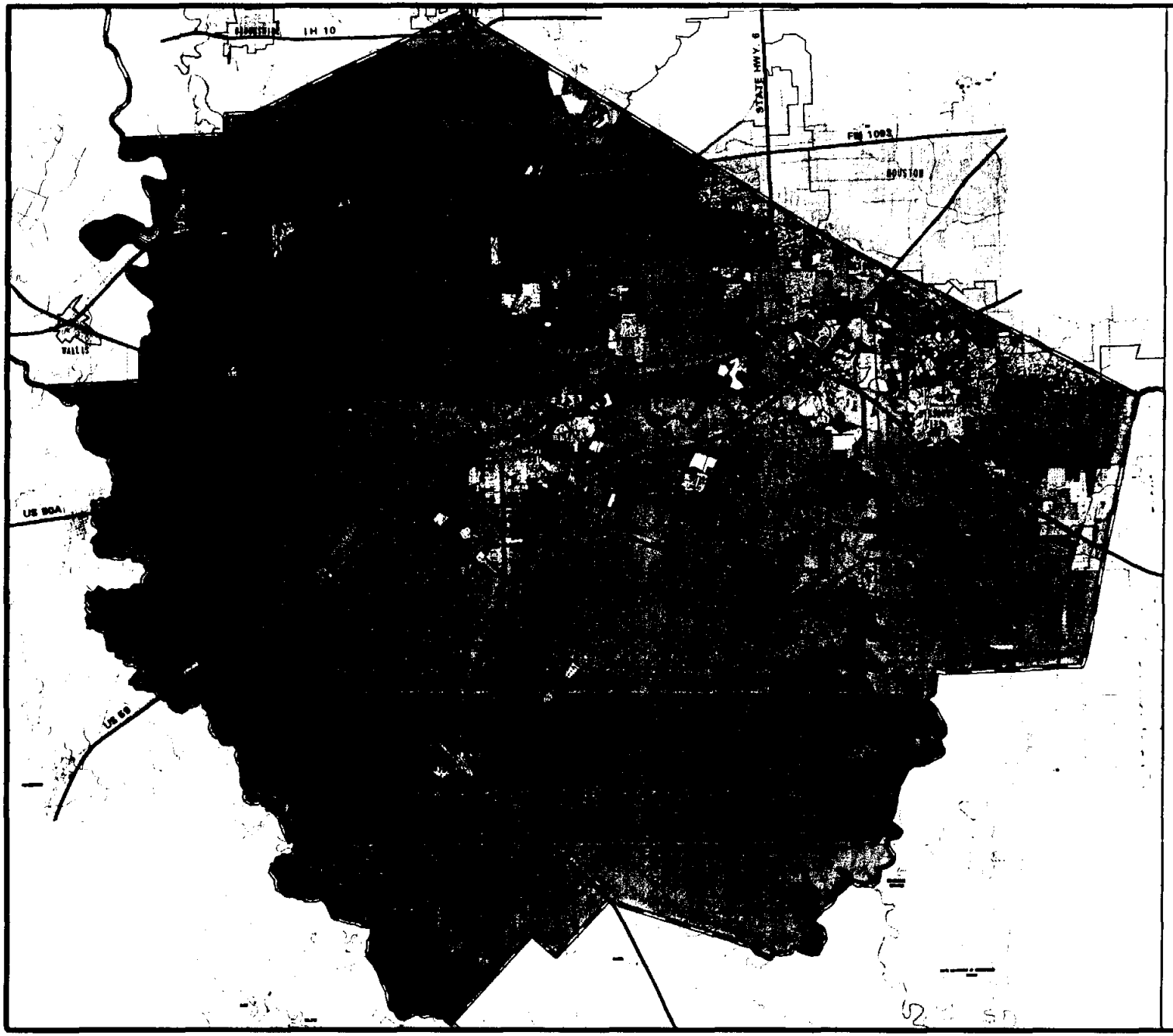
Harris-Galveston Coastal Subsidence District Regional Water Supply Planning Study - This study addressed future water demands for all or a portion of thirteen counties surrounding the City of Houston, Texas, including Fort Bend County. The principal objective of the study was to define groundwater usage. It therefore ignored certain surface water users, such as power generation, that would be considered to remain fairly stable over time. The method of population projection used in this study combined historic growth rates and land use on a census tract basis with the net land available for future growth. A target future population was derived by comparing regional projections obtained from the TWDB, Texas A&M University, and the City of Houston Water Master Plan. Future population was computed by assuming a continued historic growth rate in each census tract until 75 percent of the available land was developed, then continuing at a rate of 50 percent of the historic rate until all of the land was developed. Average water demand per gross acre of development was computed by taking the total water used in 1980 and 1986 divided by the total acreage developed in 1980 and 1986. This calculation was performed for four quadrants within the City of Houston and within the City of Houston Extra Territorial Jurisdiction to represent different majority land use classifications. The appropriate factors were then applied to areas outside the City of Houston, including Fort Bend County, to determine the projected water demand in the year 2030. The study was concerned only with the demand for additional groundwater or demand for water for which a source has not been identified. Consequently, existing surface water uses for power and irrigation were not completely identified. Instead it was assumed that water demand for power and irrigation would remain constant throughout the planning period of the study (1980 - 2030) unless land currently used for agriculture was projected to be converted to municipal land use, in which case the irrigation demand was reduced.

The H-GCSD study incorporated water conservation in two ways. First, the 1986 data used for determining unit demand factors was largely influenced by the City of Houston which, through an aggressive water rate structure, had witnessed a significant decline in water consumption. Second, the H-GCSD applied a delay in water consumption from 1986 to 1990. These two factors result in a reduction of about 15% in water demand in 1990 as compared to using extrapolated 1980 data.

TABLE V-1 COMPARISON OF WATER DEMAND PROJECTIONS
FOR FORT BEND COUNTY, TEXAS

Projection Source	Population		Estimated Municipal Average Water Demand in Fort Bend County (mgd)					Municipal Water Demand Unit Factors (gpcd)	
	1990	2030	1990	2000	2010	2020	2030	1990	2030
HGCSD (1)	223,739	763,788	123.3	148.9	174.6	200.3	226.0	165.4	156.2
TWDB Final, Average Usage (2)	221,313	599,073	162.0	168.7	182.0	195.5	211.9	138.6	165.7
TWDB Draft, High Usage (3)	226,880	662,696	128.2	155.8	178.0	195.7	218.3	162.3	154.9
TWDB Draft, Average Usage (4)	226,880	662,696	128.2	149.0	169.2	185.0	205.6	155.0	138.2
City of Houston Water Master Plan	204,812	655,068	35.8	55.1	76.1	93.5	110.2	174.7	168.2
Study Projections	225,421	680,804	37.0	48.7	64.3	84.7	111.7	164.1	164.1

(1) TWDB estimates assume average per capita water use with conservation practices. From "Projections of Population and Water Demands" dated October, 1989.
(2) TWDB estimates assume high per capita water use with conservation practices. From Draft "Projections of Population and Water Demands" dated June, 1991.
(3) TWDB estimates assume average per capita water use with conservation practices. From Draft "Projections of Population and Water Demands" dated June, 1991.
Note: Preliminary 1990 Census count = 225,421.



KEY TO BASE MAP

- Corporate Limits
- County Line
- Water Features

KEY TO LAND-USE

- Single-Family
- Multi-Family
- Commercial
- Industrial
- Park/Green Space/Forest
- Water
- Agricultural/Rangeland/Barren/ Transportation/Undeveloped

N

3.5 0 3.5

Scale in Miles

EXHIBIT V-1

FORT BEND COUNTY LAND USE (1991)

FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: JUNE 1992 JOB NO. 33-0736-1000

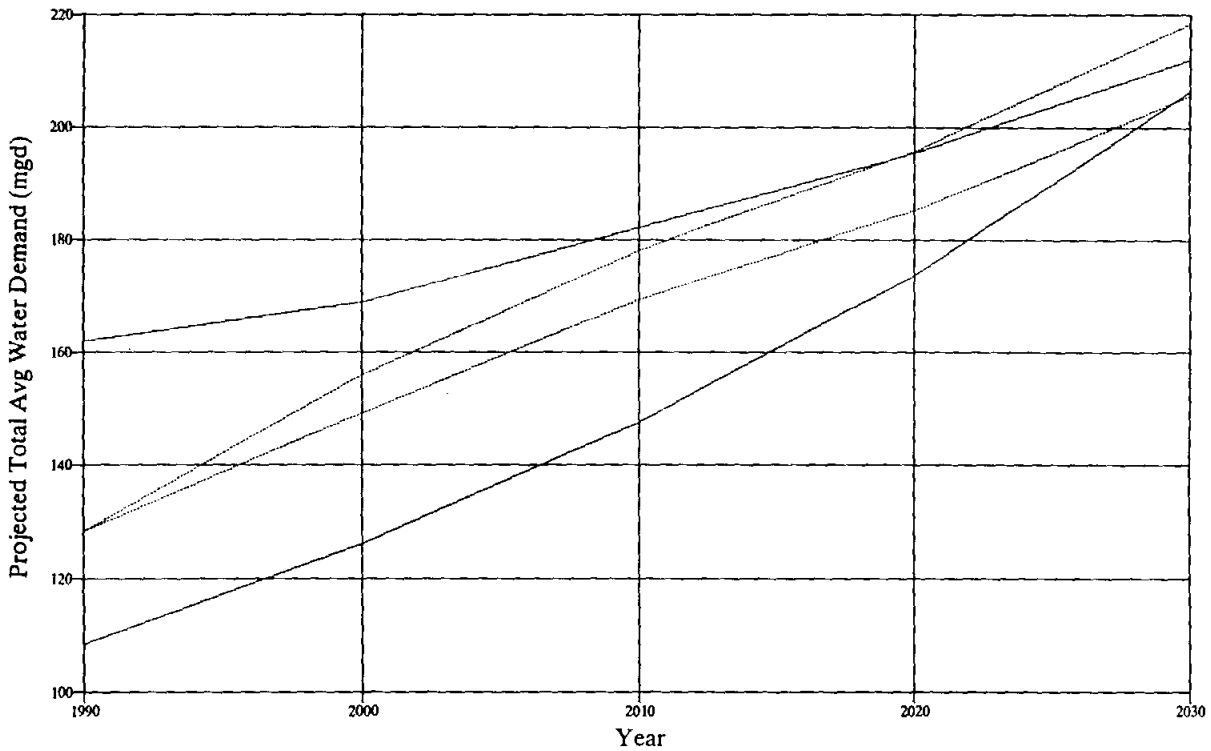


EXHIBIT V-2

WATER DEMAND COMPARISON
(STUDY PROJECTIONS VS. TWDB)
FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC

TURNER COLLIE & BRADEN INC.

DATE: JUNE, 1992 JOB No. 33-0736-1000

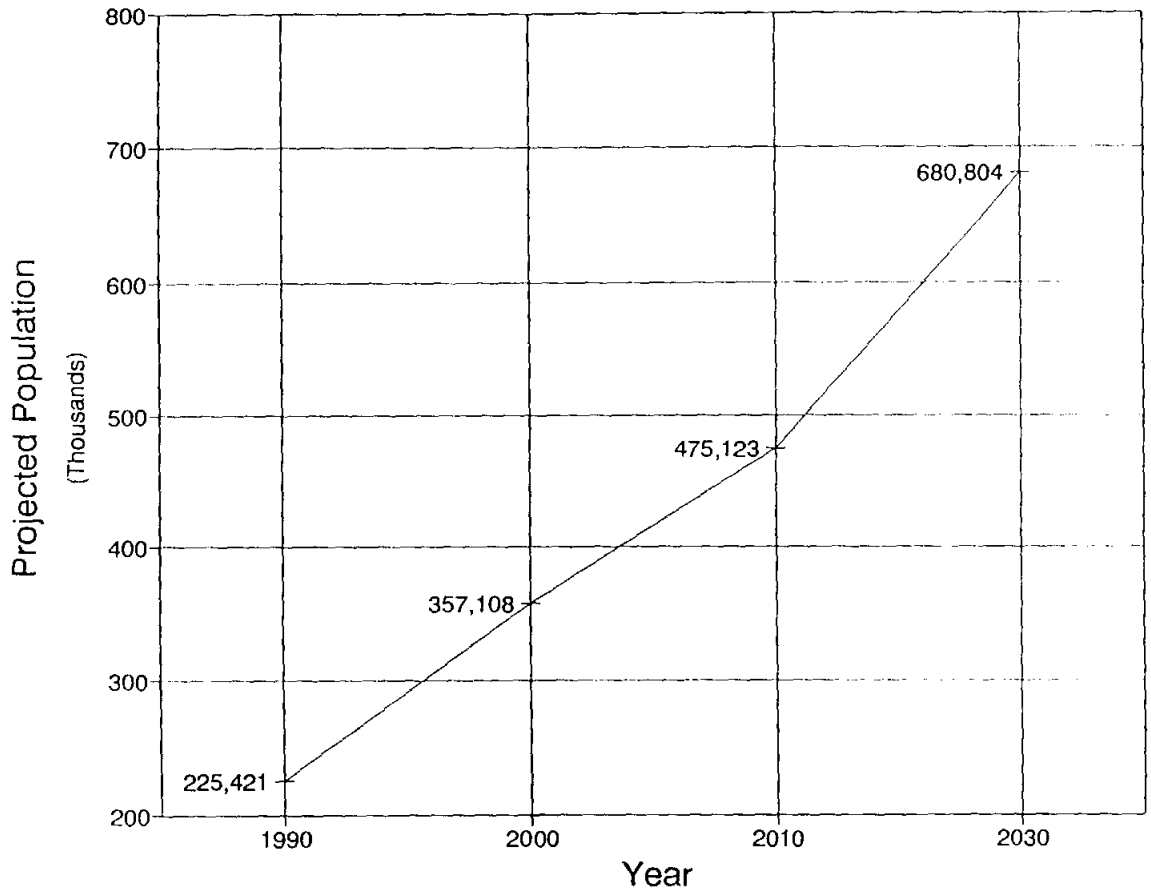


EXHIBIT V-3

POPULATION PROJECTION
FOR FORT BEND COUNTY
FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC

TURNER COLLIE & BRADEN INC.

DATE: JUNE, 1992 JOB No. 33-0736-1000

TABLE VI-5 GROUNDWATER SUPPLY FACILITIES IN FORT BEND COUNTY, 1991

	EXISTING CAPACITY	CAPACITY REQUIRED BY TWC
POPULATION SERVED	188,035	
WELL CAPACITY	76,700 GPM	38,200 GPM
GROUND STORAGE CAPACITY	31.6 million gallons	24.4 million gallons
ELEVATED STORAGE CAPACITY	9.8 million gallons	5.0 million gallons
SERVICE PUMPING CAPACITY	125,000 GPM	61,100 GPM

TABLE VI-4 PROJECTED INDUSTRIAL SUPPLY WELL COSTS (continued)

WELL	OWNER	AQUIFER	PROJECTED WELL TYPE (1)	REPLACEMENT WELL COSTS	WORKOVER WELL COSTS
184	EXXON CORPORATION	EVANG.	WORKOVER	$0	$23,475
185	EXXON CORPORATION	CHIC.	REPLACEMENT	$110,000	$0
186	EXXON CORPORATION	CHIC.	REPLACEMENT	$110,000	$0
187	EXXON CORPORATION	CHIC.	REPLACEMENT	$110,000	$0
188	EXXON CORPORATION	CHIC.	REPLACEMENT	$110,000	$0
189	EXXON CORPORATION	CHIC.	REPLACEMENT	$110,000	$0
190	EXXON CORPORATION	CHIC.	REPLACEMENT	$110,000	$0
191	EXXON CORPORATION	CHIC.	REPLACEMENT	$110,000	$0
192	EXXON CORPORATION	CHIC.	REPLACEMENT	$110,000	$0
193	EXXON CORPORATION	CHIC.	REPLACEMENT	$110,000	$0
194	EXXON CORPORATION	CHIC.	REPLACEMENT	$110,000	$0
195	EXXON CORPORATION	EVANG.	REPLACEMENT	$110,000	$0
196	WITCO CORPORATION	EVANG.	WORKOVER	$0	$31,300
197	WITCO CORPORATION	EVANG.	WORKOVER	$0	$31,300
198	WITCO CORPORATION	EVANG.	WORKOVER	$0	$31,300
199	FLEXICORE OF TEXAS, INC.	EVANG.	WORKOVER	$0	$31,300
200	FLEXICORE OF TEXAS, INC.	EVANG.	REPLACEMENT	$110,000	$0
201	FLEXICORE OF TEXAS, INC.	EVANG.	REPLACEMENT	$110,000	$0
209	FRITO-LAY, INC.	CHIC.	WORKOVER	$0	$8,430
210	FRITO-LAY, INC.	CHIC.	WORKOVER	$0	$8,430
254	BAYLOR COMPANY	EVANG.	WORKOVER	$0	$31,300
255	BAYLOR COMPANY	EVANG.	REPLACEMENT	$110,000	$0
277	HOUSTON LIGHTING & POWER COMPANY	CHIC.	REPLACEMENT	$110,000	$0
278	HOUSTON LIGHTING & POWER COMPANY	CHIC.	REPLACEMENT	$110,000	$0
324	ANADRILL/SCHLUMBERGER	EVANG.	WORKOVER	$0	$31,300
354	LEXINGTON DEVELOPMENT CO.	CHIC.	WORKOVER	$0	$23,475
363	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$23,475
364	HOUSTON LIGHTING & POWER COMPANY	EVANG.	REPLACEMENT	$110,000	$0
378	CHAMPION TECHNOLOGIES, INC.	CHIC.	REPLACEMENT	$110,000	$0
379	CHAMPION TECHNOLOGIES, INC.	CHIC.	REPLACEMENT	$110,000	$0

TABLE VI-4 PROJECTED INDUSTRIAL SUPPLY WELL COSTS (continued)

WELL	OWNER	AQUIFER	PROJECTED WELL TYPE (1)	REPLACEMENT WELL COSTS	WORKOVER WELL COSTS
380	CHAMPION TECHNOLOGIES, INC.	CHIC.	WORKOVER	$0	$23,475
382	TEXAS INDUSTRIES, INC.	CHIC.	WORKOVER	$0	$23,475
383	TEXAS INDUSTRIES, INC.	CHIC.	WORKOVER	$0	$12,645
388	FARMERS GIN COMPANY OF ROSENBERG	EVANG.	REPLACEMENT	$110,000	$0
442	SOUTHWEST RETAIL FISHING PROJECT	EVANG.	REPLACEMENT	$110,000	$0
443	SOUTHWEST RETAIL FISHING PROJECT	EVANG.	REPLACEMENT	$110,000	$0
444	SOUTHWEST RETAIL FISHING PROJECT	EVANG.	WORKOVER	$0	$12,645
452	HUDSON PRODUCTS CORPORATION	CHIC.	WORKOVER	$0	$2,250
468	D & J WATER SUPPLY, INC.	CHIC.	REPLACEMENT	$110,000	$0
469	D & J WATER SUPPLY, INC.	CHIC.	REPLACEMENT	$110,000	$0
474	ENSERCH GAS TRANSMISSION CO.	CHIC.	REPLACEMENT	$110,000	$0
475	ENSERCH GAS TRANSMISSION CO.	CHIC.	REPLACEMENT	$110,000	$0
491	FT. BEND TELEPHONE COMPANY	CHIC.	REPLACEMENT	$110,000	$0
492	FT. BEND TELEPHONE COMPANY	CHIC.	REPLACEMENT	$110,000	$0
607	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$12,645
638	BROWNING FERRIS INCORPORATED	CHIC.	WORKOVER	$0	$23,475
				$4,070,000	$772,985

NOTE:
(1) PROJECTED WORKOVER OR REPLACEMENT OF EXISTING WATER WELLS.

SOURCE: FORT BEND SUBSIDENCE DISTRICT

TABLE VI-3 PROJECTED PUBLIC SUPPLY WELL COSTS (continued)

WELL	OWNER	AQUIFER	PROJECTED WELL TYPE (1)	REPLACEMENT WELL COSTS	WORKOVER WELL COSTS
642	SUGAR LAND, CITY OF	EVANG.	WORKOVER	$0	$31,300
643	SUGAR LAND, CITY OF	EVANG.	WORKOVER	$0	$31,300
				$9,025,000	$3,069,825

NOTE:
(1) PROJECTED WORKOVER OR REPLACEMENT OF EXISTING WATER WELLS.

SOURCE: FORT BEND SUBSIDENCE DISTRICT

TABLE VI-4 PROJECTED INDUSTRIAL SUPPLY WELL COSTS

WELL	OWNER	AQUIFER	PROJECTED WELL TYPE (1)	REPLACEMENT WELL COSTS	WORKOVER WELL COSTS
117	HOUSTON LIGHTING & POWER COMPANY	EVANG.	REPLACEMENT	$110,000	$0
118	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$23,475
119	HOUSTON LIGHTING & POWER COMPANY	CHIC.	REPLACEMENT	$110,000	$0
120	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$12,645
121	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$2,050
122	HOUSTON LIGHTING & POWER COMPANY	EVANG.	REPLACEMENT	$110,000	$0
123	HOUSTON LIGHTING & POWER COMPANY	EVANG.	REPLACEMENT	$110,000	$0
124	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$15,650
125	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$12,645
126	HOUSTON LIGHTING & POWER COMPANY	EVANG.	REPLACEMENT	$110,000	$0
127	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$23,475
128	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$23,475
129	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$23,475
130	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$15,650
131	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$15,650
132	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$15,650
133	HOUSTON LIGHTING & POWER COMPANY	CHIC.	WORKOVER	$0	$23,475
146	GREAT SOUTHWEST EQUESTRIAN CTR.	CHIC.	WORKOVER	$0	$23,475
154	HOUSTON SHELL & CONCRETE CO.	EVANG.	REPLACEMENT	$110,000	$0
155	HOUSTON SHELL & CONCRETE CO.	EVANG.	REPLACEMENT	$110,000	$0
156	HOUSTON SHELL & CONCRETE CO.	EVANG.	REPLACEMENT	$110,000	$0
157	HOUSTON SHELL & CONCRETE CO.	EVANG.	REPLACEMENT	$110,000	$0
162	TEXAS INSTRUMENTS INCORPORATED	EVANG.	WORKOVER	$0	$31,300
163	TEXAS INSTRUMENTS INCORPORATED	EVANG.	WORKOVER	$0	$31,300
164	TEXAS INSTRUMENTS INCORPORATED	EVANG.	WORKOVER	$0	$31,300
174	UNITED SALT CORP.	EVANG.	WORKOVER	$0	$31,300
176	QUANEX CORP GULF STATES TUBE DIV	EVANG.	WORKOVER	$0	$15,650
177	QUANEX CORP GULF STATES TUBE DIV	EVANG.	WORKOVER	$0	$15,650
182	UNITED GAS PIPELINE CO.	CHIC.	NOT APPLIC.	$0	$0
183	UNITED GAS PIPELINE CO.	CHIC.	NOT APPLIC.	$0	$0

TABLE VI-3 PROJECTED PUBLIC SUPPLY WELL COSTS (continued)

WELL	OWNER	AQUIFER	PROJECTED WELL TYPE (1)	REPLACEMENT WELL COSTS	WORKOVER WELL COSTS
482	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0
483	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0
484	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0
485	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0
486	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0
487	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0
488	BRYNMAR LAKE ESTATES HOA	EVANG.	REPLACEMENT	$175,000	$0
490	FT. BEND CO. M.U.D. 13	CHIC.	WORKOVER	$0	$23,475
493	LAMAR C.I.S.D. - HUGGINS SCHOOL	CHIC.	WORKOVER	$0	$8,430
494	LAMAR C.I.S.D. - MEYER SCHOOL	CHIC.	WORKOVER	$0	$15,650
495	LAMAR C.I.S.D. - WILLIAMS SCHOOL	EVANG.	WORKOVER	$0	$23,475
505	CLUB AT FALCON POINT, THE	CHIC.	REPLACEMENT	$325,000	$0
537	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	WORKOVER	$0	$12,645
538	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	WORKOVER	$0	$23,475
539	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	WORKOVER	$0	$31,300
540	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	WORKOVER	$0	$31,300
541	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
542	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
543	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
544	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
545	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
546	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
547	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
548	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
549	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
550	TEXAS DEPT. CRIMINAL JUSTICE-ID	CHIC.	REPLACEMENT	$175,000	$0
551	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
552	TEXAS DEPT. CRIMINAL JUSTICE-ID	CHIC.	REPLACEMENT	$175,000	$0
553	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
554	TEXAS DEPT. CRIMINAL JUSTICE-ID	CHIC.	REPLACEMENT	$175,000	$0

TABLE VI-3 PROJECTED PUBLIC SUPPLY WELL COSTS (continued)

WELL	OWNER	AQUIFER	PROJECTED WELL TYPE (1)	REPLACEMENT WELL COSTS	WORKOVER WELL COSTS
561	GRAND MISSION WEST	CHIC.	REPLACEMENT	$175,000	$0
570	FT. BEND CO. PRECINCT 1	CHIC.	WORKOVER	$0	$23,475
580	PROVIDENT NATIONAL INSURANCE CO.	CHIC.	WORKOVER	$0	$23,475
590	SUGAR MILL COMMUNITY ASSOCIATION	EVANG.	WORKOVER	$0	$31,300
591	SUGARLAND PROPERTIES, INC.	EVANG.	WORKOVER	$0	$31,300
592	SUGARLAND PROPERTIES, INC.	CHIC.	WORKOVER	$0	$23,475
593	SUGARLAND PROPERTIES, INC.	EVANG.	WORKOVER	$0	$31,300
594	SUGARLAND PROPERTIES, INC.	EVANG.	REPLACEMENT	$175,000	$0
595	SWEETWATER COUNTRY CLUB	EVANG.	WORKOVER	$0	$31,300
596	SWEETWATER COUNTRY CLUB	EVANG.	WORKOVER	$0	$31,300
597	SWEETWATER COUNTRY CLUB	EVANG.	WORKOVER	$0	$31,300
598	SWEETWATER COUNTRY CLUB	EVANG.	WORKOVER	$0	$31,300
606	B S S HINDU TEMPLE	EVANG.	REPLACEMENT	$175,000	$0
608	FIRST COLONY COMM. SER. ASSOC.	EVANG.	WORKOVER	$0	$31,300
609	FIRST COLONY COMM. SER. ASSOC.	EVANG.	WORKOVER	$0	$31,300
615	PLAY BALL, INC.	CHIC.	REPLACEMENT	$175,000	$0
616	PLAY BALL, INC.	CHIC.	REPLACEMENT	$175,000	$0
617	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	WORKOVER	$0	$23,475
618	TEXAS DEPT. CRIMINAL JUSTICE-ID	EVANG.	REPLACEMENT	$175,000	$0
619	THOMPSONS, TOWN OF	CHIC.	WORKOVER	$0	$12,645
620	THOMPSONS, TOWN OF	CHIC.	WORKOVER	$0	$12,645
634	NEW TERRITORY RESID. COMM.ASSOC.	CHIC.	WORKOVER	$0	$23,475
635	NEW TERRITORY RESID. COMM.ASSOC.	EVANG.	WORKOVER	$0	$23,475
636	BAY RIDGE CHRISTIAN COLLEGE	CHIC.	REPLACEMENT	$175,000	$0
637	BAY RIDGE CHRISTIAN COLLEGE	CHIC.	REPLACEMENT	$175,000	$0

TABLE VI-3 PROJECTED PUBLIC SUPPLY WELL COSTS (continued)

WELL	OWNER	AQUIFER	PROJECTED WELL TYPE (1)	REPLACEMENT WELL COSTS	WORKOVER WELL COSTS
226	PECAN GROVE COUNTRY CLUB	EVANG.	WORKOVER	$0	$12,645
227	PECAN GROVE COUNTRY CLUB	EVANG.	WORKOVER	$0	$23,475
228	PECAN GROVE M.U.D.	EVANG.	WORKOVER	$0	$23,475
229	PECAN GROVE M.U.D.	EVANG.	WORKOVER	$0	$23,475
230	PECAN GROVE M.U.D.	EVANG.	WORKOVER	$0	$23,475
231	PECAN GROVE M.U.D.	EVANG.	WORKOVER	$0	$23,475
232	PLANTATION M.U.D.	CHIC.	WORKOVER	$0	$23,475
233	PLANTATION M.U.D.	CHIC.	WORKOVER	$0	$23,475
234	FT. BEND CO. M.U.D. 42	EVANG.	WORKOVER	$0	$31,300
235	BIG OAKS M.U.D.	EVANG.	WORKOVER	$0	$31,300
236	CHELFORD CITY M.U.D.	EVANG.	WORKOVER	$0	$31,300
237	CHELFORD CITY M.U.D.	EVANG.	WORKOVER	$0	$31,300
238	FT. BEND CO. M.U.D. 13	EVANG.	WORKOVER	$0	$31,300
239	FT. BEND CO. M.U.D. 13	EVANG.	WORKOVER	$0	$31,300
240	FT. BEND CO. M.U.D. 13	CHIC.	WORKOVER	$0	$23,475
241	FT. BEND CO. M.U.D. 25	EVANG.	WORKOVER	$0	$31,300
242	FT. BEND CO. M.U.D. 25	EVANG.	WORKOVER	$0	$31,300
243	FT. BEND CO. M.U.D. 30	EVANG.	WORKOVER	$0	$31,300
244	FT. BEND CO. M.U.D. 34	CHIC.	WORKOVER	$0	$23,475
245	FT. BEND CO. M.U.D. 41	EVANG.	WORKOVER	$0	$31,300
246	FT. BEND CO. M.U.D. 69	CHIC.	WORKOVER	$0	$23,475
247	GRAND MISSION M.U.D.	CHIC.	WORKOVER	$0	$23,475
248	KINGSBRIDGE M.U.D.	EVANG.	WORKOVER	$0	$31,300
249	MISSION BEND M.U.D. 1	EVANG.	WORKOVER	$0	$31,300
250	NORTH MISSION GLEN M.U.D.	EVANG.	WORKOVER	$0	$31,300
251	VIA RANCH M.U.D. 4	CHIC.	WORKOVER	$0	$23,475
252	FT. BEND CO. M.U.D. 26	EVANG.	WORKOVER	$0	$31,300
253	FT. BEND CO. M.U.D. 26	EVANG.	REPLACEMENT	$175,000	$0
256	MEADOWCREEK M.U.D.	EVANG.	WORKOVER	$0	$31,300
257	QUAIL VALLEY U.D.	EVANG.	WORKOVER	$0	$31,300

TABLE VI-3 PROJECTED PUBLIC SUPPLY WELL COSTS (continued)

WELL	OWNER	AQUIFER	PROJECTED WELL TYPE (1)	REPLACEMENT WELL COSTS	WORKOVER WELL COSTS
258	QUAIL VALLEY U.D.	EVANG.	WORKOVER	$0	$31,300
259	QUAIL VALLEY U.D.	EVANG.	WORKOVER	$0	$31,300
260	QUAIL VALLEY U.D.	EVANG.	WORKOVER	$0	$31,300
261	THUNDERBIRD U.D.	EVANG.	WORKOVER	$0	$23,475
262	THUNDERBIRD U.D.	EVANG.	WORKOVER	$0	$23,475
263	THUNDERBIRD U.D.	EVANG.	WORKOVER	$0	$31,300
264	PALMER PLANTATION M.U.D. 1	EVANG.	WORKOVER	$0	$23,475
275	QUAIL VALLEY COUNTRY CLUB	EVANG.	WORKOVER	$0	$23,475
276	QUAIL VALLEY COUNTRY CLUB	EVANG.	WORKOVER	$0	$31,300
279	FIRST COLONY M.U.D. 9	EVANG.	WORKOVER	$0	$31,300
309	FT. BEND CO. M.U.D. 69	CHIC.	WORKOVER	$0	$23,475
343	ORCHARD, CITY OF	CHIC.	REPLACEMENT	$175,000	$0
353	GENERAL HOMES	CHIC.	REPLACEMENT	$175,000	$0
357	LAKE OLYMPIA CIVIC ASSOCIATION	EVANG.	REPLACEMENT	$175,000	$0
358	LAKE OLYMPIA CIVIC ASSOCIATION	EVANG.	REPLACEMENT	$175,000	$0
359	KENDLETON, CITY OF	CHIC.	WORKOVER	$0	$15,650
360	KENDLETON, CITY OF	CHIC.	WORKOVER	$0	$15,650
366	HINES NURSERIES, INC.	CHIC.	WORKOVER	$0	$8,430
445	BAY RIDGE CHRISTIAN COLLEGE	CHIC.	NOT APPLIC.	$0	$0
446	HOUSTON INTERNATIONAL TELEPORT	EVANG.	REPLACEMENT	$175,000	$0
447	FT. BEND CO. M.U.D. 106	CHIC.	WORKOVER	$0	$23,475
448	NEWLAND TEXAS	CHIC.	WORKOVER	$0	$23,475
449	NEWLAND TEXAS	CHIC.	WORKOVER	$0	$23,475
451	FT. BEND CO. PRECINCT 3	CHIC.	WORKOVER	$0	$23,475
476	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0
477	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0
478	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0
479	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0
480	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0
481	HOUSTON HULL AIRPORT	EVANG.	REPLACEMENT	$175,000	$0

TABLE VI-3 PROJECTED PUBLIC SUPPLY WELL COSTS

WELL	OWNER	AQUIFER	PROJECTED WELL TYPE (1)	REPLACEMENT WELL COSTS	WORKOVER WELL COSTS
101	RICHMOND, CITY OF	CHIC.	WORKOVER	$0	$8,430
102	RICHMOND, CITY OF	CHIC.	WORKOVER	$0	$15,650
103	RICHMOND, CITY OF	CHIC.	WORKOVER	$0	$15,650
104	RICHMOND, CITY OF	CHIC.	WORKOVER	$0	$15,650
105	BLUE RIDGE WEST M.U.D.	EVANG.	WORKOVER	$0	$31,300
106	BLUE RIDGE WEST M.U.D.	EVANG.	WORKOVER	$0	$31,300
107	FT. BEND CO. M.U.D. 2	EVANG.	WORKOVER	$0	$31,300
108	FT. BEND CO. M.U.D. 2	EVANG.	WORKOVER	$0	$31,300
109	HOUSTON, CITY OF	EVANG.	WORKOVER	$0	$31,300
110	HOUSTON, CITY OF	EVANG.	WORKOVER	$0	$31,300
111	HOUSTON, CITY OF	EVANG.	WORKOVER	$0	$31,300
112	HOUSTON, CITY OF	EVANG.	WORKOVER	$0	$31,300
113	HOUSTON, CITY OF	EVANG.	WORKOVER	$0	$31,300
114	HOUSTON, CITY OF - SIMS PLANT	EVANG.	WORKOVER	$0	$31,300
115	NEEDVILLE, CITY OF	CHIC.	WORKOVER	$0	$2,250
116	NEEDVILLE, CITY OF	CHIC.	WORKOVER	$0	$2,250
134	ROSENBERG, CITY OF	CHIC.	WORKOVER	$0	$15,650
135	ROSENBERG, CITY OF	EVANG.	WORKOVER	$0	$15,650
136	ROSENBERG, CITY OF	EVANG.	WORKOVER	$0	$15,650
137	ROSENBERG, CITY OF	EVANG.	WORKOVER	$0	$15,650
138	ROSENBERG, CITY OF	EVANG.	WORKOVER	$0	$15,650
139	SUGAR LAND, CITY OF	EVANG.	REPLACEMENT	$325,000	$0
140	SUGAR LAND, CITY OF	EVANG.	WORKOVER	$0	$31,300
141	SUGAR LAND, CITY OF	EVANG.	WORKOVER	$0	$31,300
142	SUGAR LAND, CITY OF	EVANG.	WORKOVER	$0	$31,300
143	SUGAR LAND, CITY OF	EVANG.	WORKOVER	$0	$31,300
144	SUGAR LAND, CITY OF	EVANG.	WORKOVER	$0	$31,300
145	SUGAR LAND, CITY OF	EVANG.	WORKOVER	$0	$31,300
147	CINCO M.U.D. #1	CHIC.	WORKOVER	$0	$23,475
148	FT. BEND CO. M.U.D. 37	CHIC.	WORKOVER	$0	$15,650

TABLE VI-3 PROJECTED PUBLIC SUPPLY WELL COSTS (continued)

WELL	OWNER	AQUIFER	PROJECTED WELL TYPE (1)	REPLACEMENT WELL COSTS	WORKOVER WELL COSTS
149	FT. BEND CO. M.U.D. 47/48	EVANG.	WORKOVER	$0	$23,475
150	BEASLEY, TOWN OF	CHIC.	WORKOVER	$0	$2,250
151	BEASLEY, TOWN OF	CHIC.	WORKOVER	$0	$2,250
166	WILLOWISP COUNTRY CLUB, INC.	EVANG.	REPLACEMENT	$175,000	$0
167	WILLOWISP COUNTRY CLUB, INC.	EVANG.	REPLACEMENT	$325,000	$0
168	WILLOWISP COUNTRY CLUB, INC.	EVANG.	REPLACEMENT	$175,000	$0
169	FT. BEND CO. M.U.D. 23	CHIC.	WORKOVER	$0	$23,475
170	FT. BEND CO. M.U.D. 46	EVANG.	WORKOVER	$0	$23,475
171	FT. BEND CO. M.U.D. 50	CHIC.	WORKOVER	$0	$23,475
172	NEEDVILLE I.S.D.	CHIC.	WORKOVER	$0	$2,050
173	NEEDVILLE I.S.D.	CHIC.	WORKOVER	$0	$2,050
175	VENETIAN ESTATE PROP OWNER ASSOC	EVANG.	REPLACEMENT	$175,000	$0
178	FT. BEND UTILITIES CO.	EVANG.	WORKOVER	$0	$31,300
179	FT. BEND UTILITIES CO.	EVANG.	WORKOVER	$0	$31,300
181	FT. BEND UTILITIES CO.	EVANG.	WORKOVER	$0	$31,300
202	MEADOWS M.U.D., THE	EVANG.	WORKOVER	$0	$31,300
203	MEADOWS M.U.D., THE	EVANG.	WORKOVER	$0	$31,300
204	KATY, CITY OF	CHIC.	WORKOVER	$0	$15,650
212	MILL BROOK WATER & SANITARY,INC.	CHIC.	REPLACEMENT	$175,000	$0
213	MILL BROOK WATER & SANITARY,INC.	CHIC.	REPLACEMENT	$175,000	$0
214	MILL BROOK WATER & SANITARY,INC.	CHIC.	WORKOVER	$0	$8,430
217	FT. BEND CO. M.U.D. 81	CHIC.	WORKOVER	$0	$2,250
218	FT. BEND CO. M.U.D. 81	CHIC.	WORKOVER	$0	$2,250
219	FT. BEND CO. M.U.D. 81	CHIC.	WORKOVER	$0	$2,250
220	FT. BEND CO. W.C.&I.D. 2	EVANG.	WORKOVER	$0	$31,300
221	FT. BEND CO. W.C.&I.D. 2	EVANG.	WORKOVER	$0	$31,300
222	FT. BEND CO. W.C.&I.D. 2	EVANG.	WORKOVER	$0	$31,300
223	FT. BEND CO. W.C.&I.D. 2	EVANG.	WORKOVER	$0	$31,300
224	FT. BEND CO. W.C.&I.D. 2	EVANG.	WORKOVER	$0	$31,300
225	FT. BEND CO. W.C.&I.D. 2	EVANG.	WORKOVER	$0	$31,300

Table VI-2 PROJECTED POTENTIOMETRIC LEVEL DECLINES IN EXISTING WELLS IN FORT BEND COUNTY

WELL	OWNER	GRD. ELEV.* (FEET)	1987 WATER ELEV.* (FT)	1987 DEPTH** TO WATER LEVEL (FEET)	2030 PROJECTED WATER LEVEL DROP (-) (FEET)	DEPTH** TO TOP OF 1ST SCREEN (FEET)	TOTAL WELL DEPTH** (FEET)	AQUIFER	WATER USE***
193	EXXON CORPORATION	55	-20	75	-71	100	130	CHIC.	N
194	EXXON CORPORATION	55	-20	75	-71	90	100	CHIC.	N
195	EXXON CORPORATION	70	-130	200	-104	140	290	EVANG.	N
196	WITCO CORPORATION	65	-130	195	-137	579	618	EVANG.	N
197	WITCO CORPORATION	65	-130	195	-137	581	596	EVANG.	N
198	WITCO CORPORATION	65	-130	195	-137	367	379	EVANG.	N
199	FLEXICORE OF TEXAS, INC.	65	-130	195	-137	418	430	EVANG.	N
200	FLEXICORE OF TEXAS, INC.	65	-130	195	-137	252	260	EVANG.	N
201	FLEXICORE OF TEXAS, INC.	65	-130	195	-137	192	200	EVANG.	N
209	FRITO-LAY, INC.	100	30	70	-46	250	350	CHIC.	N
210	FRITO-LAY, INC.	100	30	70	-46	250	350	CHIC.	N
254	BAYLOR COMPANY	70	-200	270	-140	432	450	EVANG.	N
255	BAYLOR COMPANY	70	-200	270	-140	300	320	EVANG.	N
277	HOUSTON LIGHTING & POWER COMPAN	55	-50	105	-92	0	0	CHIC.	N
278	HOUSTON LIGHTING & POWER COMPAN	55	-50	105	-92	10	230	CHIC.	N
324	ANADRILL/SCHLUMBERGER	70	-200	270	-140	823	1,097	EVANG.	N
354	LEXINGTON DEVELOPMENT CO.	75	-40	115	-110	440	500	CHIC.	N
363	HOUSTON LIGHTING & POWER COMPAN	55	-50	105	-92	340	350	CHIC.	N
364	HOUSTON LIGHTING & POWER COMPAN	70	-165	235	-129	340	350	EVANG.	N
378	CHAMPION TECHNOLOGIES, INC.	65	-60	125	-109	0	85	CHIC.	N
379	CHAMPION TECHNOLOGIES, INC.	65	-60	125	-116	156	172	CHIC.	N
380	CHAMPION TECHNOLOGIES, INC.	65	-60	125	-116	380	400	CHIC.	N
382	TEXAS INDUSTRIES, INC.	90	-5	95	-109	308	609	CHIC.	N
383	TEXAS INDUSTRIES, INC.	90	-5	95	-109	300	347	CHIC.	N
388	FARMERS GIN COMPANY OF ROSENBER	100	-20	120	-44	0	0	EVANG.	N
442	SOUTHWEST RETAIL FISHING PROJECT	75	-60	135	-81	42	52	EVANG.	N
443	SOUTHWEST RETAIL FISHING PROJECT	75	-60	135	-81	42	52	EVANG.	N

Table VI-2 PROJECTED POTENTIOMETRIC LEVEL DECLINES IN EXISTING WELLS IN FORT BEND COUNTY

WELL	OWNER	GRD. ELEV.* (FEET)	1987 WATER ELEV.* (FT)	1987 DEPTH** TO WATER LEVEL (FEET)	2030 PROJECTED WATER LEVEL DROP (-) (FEET)	DEPTH** TO TOP OF 1ST SCREEN (FEET)	TOTAL WELL DEPTH** (FEET)	AQUIFER	WATER USE***
444	SOUTHWEST RETAIL FISHING PROJECT	75	-60	135	-81	224	234	EVANG.	N
452	HUDSON PRODUCTS CORPORATION	95	50	45	-21	1,080	1,200	CHIC.	N
468	D & J WATER SUPPLY, INC.	55	-20	75	-89	65	75	CHIC.	N
469	D & J WATER SUPPLY, INC.	55	-20	75	-89	65	75	CHIC.	N
474	ENSERCH GAS TRANSMISSION CO.	70	40	30	-15	0	125	CHIC.	N
475	ENSERCH GAS TRANSMISSION CO.	70	40	30	-15	0	225	CHIC.	N
491	FT. BEND TELEPHONE COMPANY	110	5	105	-95	200	260	CHIC.	N
492	FT. BEND TELEPHONE COMPANY	65	-35	100	-44	0	95	CHIC.	N
607	HOUSTON LIGHTING & POWER COMPAN	55	-50	105	-92	290	300	CHIC.	N
638	BROWNING FERRIS INCORPORATED	65	-60	125	-116	450	500	CHIC.	N

NOTE:

* REFERENCES TO ELEVATION ARE WITH RESPECT TO MEAN SEA LEVEL(msl)

** REFERENCES TO DEPTH ARE WITH RESPECT TO GROUND SURFACE

***ABBREVIATIONS: P - Public supply, N - Industrial, I - Irrigation

SOURCE: FORT BEND SUBSIDENCE DISTRICT

Table VI-2 PROJECTED POTENTIOMETRIC LEVEL DECLINES IN EXISTING WELLS IN FORT BEND COUNTY

WELL	OWNER	GRD. ELEV.* (FEET)	1987 WATER ELEV.* (FT)	1987 DEPTH** TO WATER LEVEL (FEET)	2030 PROJECTED WATER LEVEL DROP (-) (FEET)	DEPTH** TO TOP OF 1ST SCREEN (FEET)	TOTAL WELL DEPTH** (FEET)	AQUIFER	WATER USE***
606	B S S HINDU TEMPLE	70	-225	295	-151	330	350	EVANG.	P
608	FIRST COLONY COMM. SER. ASSOC.	70	-150	220	-126	460	525	EVANG.	P
609	FIRST COLONY COMM. SER. ASSOC.	70	-165	235	-129	475	550	EVANG.	P
615	PLAY BALL, INC.	110	5	105	-92	0	0	CHIC.	P
616	PLAY BALL, INC.	110	5	105	-92	0	0	CHIC.	P
617	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-70	145	-104	330	361	EVANG.	P
618	TEXAS DEPT. CRIMINAL JUSTICE-ID	90	-150	240	-130	75	90	EVANG.	P
619	THOMPSONS, TOWN OF	55	-50	105	-92	245	260	CHIC.	P
620	THOMPSONS, TOWN OF	55	-50	105	-92	245	260	CHIC.	P
634	NEW TERRITORY RESID. COMM.ASSOC.	75	-40	115	-110	440	500	CHIC.	P
635	NEW TERRITORY RESID. COMM.ASSOC.	100	-65	165	-84	440	500	EVANG.	P
636	BAY RIDGE CHRISTIAN COLLEGE	95	65	30	-89	100	150	CHIC.	P
637	BAY RIDGE CHRISTIAN COLLEGE	95	65	30	-89	100	150	CHIC.	P
642	SUGAR LAND, CITY OF	70	-200	270	-140	800	1,100	EVANG.	P
643	SUGAR LAND, CITY OF	70	-200	270	-140	800	1,100	EVANG.	P
117	HOUSTON LIGHTING & POWER COMPAN	70	-175	245	-131	315	330	EVANG.	N
118	HOUSTON LIGHTING & POWER COMPAN	55	-20	75	-89	311	321	CHIC.	N
119	HOUSTON LIGHTING & POWER COMPAN	100	15	85	-79	0	0	CHIC.	N
120	HOUSTON LIGHTING & POWER COMPAN	55	-50	105	-92	210	230	CHIC.	N
121	HOUSTON LIGHTING & POWER COMPAN	115	55	60	-26	232	242	CHIC.	N
122	HOUSTON LIGHTING & POWER COMPAN	65	-130	195	-131	250	260	EVANG.	N
123	HOUSTON LIGHTING & POWER COMPAN	100	-50	150	-63	200	210	EVANG.	N
124	HOUSTON LIGHTING & POWER COMPAN	110	15	95	-74	316	326	CHIC.	N
125	HOUSTON LIGHTING & POWER COMPAN	90	-5	95	-110	232	242	CHIC.	N
126	HOUSTON LIGHTING & POWER COMPAN	70	-200	270	-140	330	345	EVANG.	N
127	HOUSTON LIGHTING & POWER COMPAN	70	-50	120	-96	540	702	CHIC.	N
128	HOUSTON LIGHTING & POWER COMPAN	70	-50	120	-96	457	803	CHIC.	N

Table VI-2 PROJECTED POTENTIOMETRIC LEVEL DECLINES IN EXISTING WELLS IN FORT BEND COUNTY

WELL	OWNER	GRD. ELEV.* (FEET)	1987 WATER ELEV.* (FT)	1987 DEPTH** TO WATER LEVEL (FEET)	2030 PROJECTED WATER LEVEL DROP (-) (FEET)	DEPTH** TO TOP OF 1ST SCREEN (FEET)	TOTAL WELL DEPTH** (FEET)	AQUIFER	WATER USE***
129	HOUSTON LIGHTING & POWER COMPAN	70	-50	120	-96	457	803	CHIC.	N
130	HOUSTON LIGHTING & POWER COMPAN	70	-35	105	-71	460	851	CHIC.	N
131	HOUSTON LIGHTING & POWER COMPAN	70	-35	105	-71	446	851	CHIC.	N
132	HOUSTON LIGHTING & POWER COMPAN	70	-35	105	-71	400	850	CHIC.	N
133	HOUSTON LIGHTING & POWER COMPAN	70	-50	120	-96	490	859	CHIC.	N
146	GREAT SOUTHWEST EQUESTRIAN CTR.	110	5	105	-95	368	398	CHIC.	N
154	HOUSTON SHELL & CONCRETE CO.	70	-225	295	-151	290	311	EVANG.	N
155	HOUSTON SHELL & CONCRETE CO.	70	-225	295	-151	290	311	EVANG.	N
156	HOUSTON SHELL & CONCRETE CO.	80	-215	295	-150	382	420	EVANG.	N
157	HOUSTON SHELL & CONCRETE CO.	80	-215	295	-150	382	420	EVANG.	N
162	TEXAS INSTRUMENTS INCORPORATED	70	-225	295	-151	690	1,020	EVANG.	N
163	TEXAS INSTRUMENTS INCORPORATED	70	-225	295	-151	522	934	EVANG.	N
164	TEXAS INSTRUMENTS INCORPORATED	70	-225	295	-151	700	1,030	EVANG.	N
174	UNITED SALT CORP.	65	-130	195	-131	464	488	EVANG.	N
176	QUANEX CORP GULF STATES TUBE DIV	100	-20	120	-44	730	875	EVANG.	N
177	QUANEX CORP GULF STATES TUBE DIV	100	-20	120	-44	998	1,178	EVANG.	N
182	UNITED GAS PIPELINE CO.	70	40	30	-15	315	363	CHIC.	N
183	UNITED GAS PIPELINE CO.	70	40	30	-15	315	365	CHIC.	N
184	EXXON CORPORATION	75	-70	145	-104	320	380	EVANG.	N
185	EXXON CORPORATION	55	-20	75	-71	100	130	CHIC.	N
186	EXXON CORPORATION	55	-20	75	-71	100	130	CHIC.	N
187	EXXON CORPORATION	55	-20	75	-71	100	130	CHIC.	N
188	EXXON CORPORATION	55	-20	75	-71	100	130	CHIC.	N
189	EXXON CORPORATION	55	-20	75	-71	100	130	CHIC.	N
190	EXXON CORPORATION	55	-20	75	-71	100	130	CHIC.	N
191	EXXON CORPORATION	55	-20	75	-71	100	130	CHIC.	N
192	EXXON CORPORATION	55	-20	75	-71	100	130	CHIC.	N

Table VI-2 PROJECTED POTENTIOMETRIC LEVEL DECLINES IN EXISTING WELLS IN FORT BEND COUNTY

WELL	OWNER	GRD. ELEV.* (FEET)	1987 WATER ELEV.* (FT)	1987 DEPTH** TO WATER LEVEL (FEET)	2030 PROJECTED WATER LEVEL DROP (-) (FEET)	DEPTH** TO TOP OF 1ST SCREEN (FEET)	TOTAL WELL DEPTH** (FEET)	AQUIFER	WATER USE***
445	BAY RIDGE CHRISTIAN COLLEGE	95	65	30	-11	115	350	CHIC.	P
446	HOUSTON INTERNATIONAL TELEPORT	70	-175	245	-131	60	80	EVANG.	P
447	FT. BEND CO. M.U.D. 106	75	-40	115	-94	1,574	1,942	CHIC.	P
448	NEWLAND TEXAS	75	-40	115	-94	325	445	CHIC.	P
449	NEWLAND TEXAS	75	-40	115	-94	340	440	CHIC.	P
451	FT. BEND CO. PRECINCT 3	90	-5	95	-110	320	336	CHIC.	P
476	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
477	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
478	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
479	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
480	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
481	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
482	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
483	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
484	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
485	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
486	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
487	HOUSTON HULL AIRPORT	75	-180	255	-132	0	0	EVANG.	P
488	BRYNMAR LAKE ESTATES HOA	110	-70	180	-88	0	0	EVANG.	P
490	FT. BEND CO. M.U.D. 13	75	-90	165	-119	660	1,115	CHIC.	P
493	LAMAR C.I.S.D. - HUGGINS SCHOOL	115	40	75	-41	173	193	CHIC.	P
494	LAMAR C.I.S.D. - MEYER SCHOOL	85	25	60	-49	860	900	CHIC.	P
495	LAMAR C.I.S.D. - WILLIAMS SCHOOL	75	-60	135	-81	600	666	EVANG.	P
505	CLUB AT FALCON POINT, THE	110	5	105	-95	90	600	CHIC.	P
537	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-70	145	-104	282	336	EVANG.	P
538	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-70	145	-104	750	1,040	EVANG.	P
539	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-130	205	-121	550	632	EVANG.	P

Table VI-2 PROJECTED POTENTIOMETRIC LEVEL DECLINES IN EXISTING WELLS IN FORT BEND COUNTY

WELL	OWNER	GRD. ELEV.* (FEET)	1987 WATER ELEV.* (FT)	1987 DEPTH** TO WATER LEVEL (FEET)	2030 PROJECTED WATER LEVEL DROP (-) (FEET)	DEPTH** TO TOP OF 1ST SCREEN (FEET)	TOTAL WELL DEPTH** (FEET)	AQUIFER	WATER USE***
540	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-180	255	-132	550	702	EVANG.	P
541	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-180	255	-132	312	406	EVANG.	P
542	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-180	255	-132	320	407	EVANG.	P
543	TEXAS DEPT. CRIMINAL JUSTICE-ID	90	-150	240	-130	75	85	EVANG.	P
544	TEXAS DEPT. CRIMINAL JUSTICE-ID	90	-150	240	-130	75	85	EVANG.	P
545	TEXAS DEPT. CRIMINAL JUSTICE-ID	90	-150	240	-130	75	85	EVANG.	P
546	TEXAS DEPT. CRIMINAL JUSTICE-ID	90	-150	240	-130	75	85	EVANG.	P
547	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-70	145	-104	75	85	EVANG.	P
548	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-130	205	-121	75	90	EVANG.	P
549	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-180	255	-132	75	90	EVANG.	P
550	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-90	165	-119	75	90	CHIC.	P
551	TEXAS DEPT. CRIMINAL JUSTICE-ID	70	-165	235	-129	85	95	EVANG.	P
552	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-40	115	-110	0	60	CHIC.	P
553	TEXAS DEPT. CRIMINAL JUSTICE-ID	90	-150	240	-130	75	85	EVANG.	P
554	TEXAS DEPT. CRIMINAL JUSTICE-ID	75	-90	165	-119	75	85	CHIC.	P
561	GRAND MISSION WEST	90	-5	95	-110	0	0	CHIC.	P
570	FT. BEND CO. PRECINCT 1	75	-40	115	-94	321	336	CHIC.	P
580	PROVIDENT NATIONAL INSURANCE CO.	75	-90	165	-119	350	400	CHIC.	P
590	SUGAR MILL COMMUNITY ASSOCIATION	75	-180	255	-132	480	550	EVANG.	P
591	SUGARLAND PROPERTIES, INC.	70	-150	220	-126	460	530	EVANG.	P
592	SUGARLAND PROPERTIES, INC.	75	-90	165	-119	460	530	CHIC.	P
593	SUGARLAND PROPERTIES, INC.	70	-150	220	-126	480	525	EVANG.	P
594	SUGARLAND PROPERTIES, INC.	70	-200	270	-140	400	460	EVANG.	P
595	SWEETWATER COUNTRY CLUB	70	-150	220	-126	460	530	EVANG.	P
596	SWEETWATER COUNTRY CLUB	70	-150	220	-126	480	525	EVANG.	P
597	SWEETWATER COUNTRY CLUB	70	-150	220	-126	480	525	EVANG.	P
598	SWEETWATER COUNTRY CLUB	70	-150	220	-126	480	525	EVANG.	P

Table VI-2 PROJECTED POTENTIOMETRIC LEVEL DECLINES IN EXISTING WELLS IN FORT BEND COUNTY

WELL	OWNER	GRD. ELEV.* (FEET)	1987 WATER ELEV.* (FT)	1987 DEPTH** TO WATER LEVEL (FEET)	2030 PROJECTED WATER LEVEL DROP (-) (FEET)	DEPTH** TO TOP OF 1ST SCREEN (FEET)	TOTAL WELL DEPTH** (FEET)	AQUIFER	WATER USE***
220	FT. BEND CO. W.C.&I.D. 2	70	-225	295	-151	1,210	1,600	EVANG.	P
221	FT. BEND CO. W.C.&I.D. 2	70	-225	295	-151	920	1,625	EVANG.	P
222	FT. BEND CO. W.C.&I.D. 2	70	-200	270	-140	920	1,625	EVANG.	P
223	FT. BEND CO. W.C.&I.D. 2	70	-225	295	-150	910	1,690	EVANG.	P
224	FT. BEND CO. W.C.&I.D. 2	70	-225	295	-151	908	1,433	EVANG.	P
225	FT. BEND CO. W.C.&I.D. 2	70	-225	295	-151	900	2,000	EVANG.	P
226	PECAN GROVE COUNTRY CLUB	75	-70	145	-104	251	313	EVANG.	P
227	PECAN GROVE COUNTRY CLUB	75	-70	145	-104	461	510	EVANG.	P
228	PECAN GROVE M.U.D.	75	-70	145	-104	450	542	EVANG.	P
229	PECAN GROVE M.U.D.	75	-70	145	-104	734	1,410	EVANG.	P
230	PECAN GROVE M.U.D.	75	-70	145	-104	459	900	EVANG.	P
231	PECAN GROVE M.U.D.	75	-70	145	-104	460	936	EVANG.	P
232	PLANTATION M.U.D.	75	-40	115	-94	564	810	CHIC.	P
233	PLANTATION M.U.D.	75	-40	115	-94	575	804	CHIC.	P
234	FT. BEND CO. M.U.D. 42	70	-165	235	-129	628	1,092	EVANG.	P
235	BIG OAKS M.U.D.	90	-170	260	-126	410	730	EVANG.	P
236	CHELFORD CITY M.U.D.	90	-170	260	-126	890	1,360	EVANG.	P
237	CHELFORD CITY M.U.D.	90	-170	260	-126	530	815	EVANG.	P
238	FT. BEND CO. M.U.D. 13	70	-150	220	-126	695	1,644	EVANG.	P
239	FT. BEND CO. M.U.D. 13	70	-150	220	-126	665	1,105	EVANG.	P
240	FT. BEND CO. M.U.D. 13	75	-90	165	-119	650	1,070	CHIC.	P
241	FT. BEND CO. M.U.D. 25	75	-180	255	-132	510	1,050	EVANG.	P
242	FT. BEND CO. M.U.D. 25	75	-130	205	-121	562	924	EVANG.	P
243	FT. BEND CO. M.U.D. 30	90	-170	260	-126	635	878	EVANG.	P
244	FT. BEND CO. M.U.D. 34	110	5	105	-92	696	1,105	CHIC.	P
245	FT. BEND CO. M.U.D. 41	90	-200	290	-141	1,080	1,565	EVANG.	P
246	FT. BEND CO. M.U.D. 69	75	-40	115	-110	582	1,058	CHIC.	P

Table VI-2 PROJECTED POTENTIOMETRIC LEVEL DECLINES IN EXISTING WELLS IN FORT BEND COUNTY

WELL	OWNER	GRD. ELEV.* (FEET)	1987 WATER ELEV.* (FT)	1987 DEPTH** TO WATER LEVEL (FEET)	2030 PROJECTED WATER LEVEL DROP (-) (FEET)	DEPTH** TO TOP OF 1ST SCREEN (FEET)	TOTAL WELL DEPTH** (FEET)	AQUIFER	WATER USE***
247	GRAND MISSION M.U.D.	90	-5	95	-109	466	734	CHIC.	P
248	KINGSBRIDGE M.U.D.	90	-200	290	-141	610	1,505	EVANG.	P
249	MISSION BEND M.U.D. 1	90	-170	260	-126	490	884	EVANG.	P
250	NORTH MISSION GLEN M.U.D.	90	-170	260	-126	426	1,400	EVANG.	P
251	VIA RANCH M.U.D. 4	110	5	105	-92	316	643	CHIC.	P
252	FT. BEND CO. M.U.D. 26	70	-175	245	-131	800	1,190	EVANG.	P
253	FT. BEND CO. M.U.D. 26	70	-175	245	-131	328	403	EVANG.	P
256	MEADOWCREEK M.U.D.	70	-165	235	-129	705	1,130	EVANG.	P
257	QUAIL VALLEY U.D.	70	-165	235	-129	1,080	1,200	EVANG.	P
258	QUAIL VALLEY U.D.	70	-165	235	-129	788	1,320	EVANG.	P
259	QUAIL VALLEY U.D.	70	-175	245	-131	620	1,077	EVANG.	P
260	QUAIL VALLEY U.D.	70	-165	235	-129	785	1,325	EVANG.	P
261	THUNDERBIRD U.D.	70	-130	200	-104	632	1,074	EVANG.	P
262	THUNDERBIRD U.D.	70	-140	210	-107	1,038	1,167	EVANG.	P
263	THUNDERBIRD U.D.	70	-175	245	-131	626	1,314	EVANG.	P
264	PALMER PLANTATION M.U.D. 1	70	-130	200	-104	745	1,225	EVANG.	P
275	QUAIL VALLEY COUNTRY CLUB	70	-130	200	-104	350	470	EVANG.	P
276	QUAIL VALLEY COUNTRY CLUB	70	-165	235	-129	646	747	EVANG.	P
279	FIRST COLONY M.U.D. 9	70	-165	235	-129	805	1,205	EVANG.	P
309	FT. BEND CO. M.U.D. 69	75	-90	165	-119	600	1,400	CHIC.	P
343	ORCHARD, CITY OF	115	70	45	-20	0	402	CHIC.	P
353	GENERAL HOMES	110	15	95	-74	0	0	CHIC.	P
357	LAKE OLYMPIA CIVIC ASSOCIATION	70	-130	200	-104	205	315	EVANG.	P
358	LAKE OLYMPIA CIVIC ASSOCIATION	70	-130	200	-104	205	315	EVANG.	P
359	KENDLETON, CITY OF	95	55	40	-74	850	1,000	CHIC.	P
360	KENDLETON, CITY OF	95	55	40	-74	850	1,000	CHIC.	P
366	HINES NURSERIES, INC.	110	25	85	-50	150	300	CHIC.	P

Table VI-2 PROJECTED POTENTIOMETRIC LEVEL DECLINES IN EXISTING WELLS IN FORT BEND COUNTY

WELL	OWNER	GRD. ELEV.* (FEET)	1987 WATER ELEV.* (FT)	1987 DEPTH** TO WATER LEVEL (FEET)	2030 PROJECTED WATER LEVEL DROP (-) (FEET)	DEPTH** TO TOP OF 1ST SCREEN (FEET)	TOTAL WELL DEPTH** (FEET)	AQUIFER	WATER USE***
101	RICHMOND, CITY OF	100	15	85	-79	226	433	CHIC.	P
102	RICHMOND, CITY OF	100	15	85	-79	317	451	CHIC.	P
103	RICHMOND, CITY OF	100	15	85	-79	406	519	CHIC.	P
104	RICHMOND, CITY OF	100	15	85	-79	564	848	CHIC.	P
105	BLUE RIDGE WEST M.U.D.	70	-175	245	-131	770	1,032	EVANG.	P
106	BLUE RIDGE WEST M.U.D.	70	-175	245	-131	810	1,155	EVANG.	P
107	FT. BEND CO. M.U.D. 2	90	-200	290	-141	568	909	EVANG.	P
108	FT. BEND CO. M.U.D. 2	90	-200	290	-141	546	979	EVANG.	P
109	HOUSTON, CITY OF	70	-225	295	-150	792	1,045	EVANG.	P
110	HOUSTON, CITY OF	65	-250	315	-150	758	1,220	EVANG.	P
111	HOUSTON, CITY OF	65	-130	195	-131	729	845	EVANG.	P
112	HOUSTON, CITY OF	65	-130	195	-137	766	1,050	EVANG.	P
113	HOUSTON, CITY OF	65	-130	195	-131	648	1,099	EVANG.	P
114	HOUSTON, CITY OF - SIMS PLANT	70	-225	295	-150	656	1,190	EVANG.	P
115	NEEDVILLE, CITY OF	85	35	50	-31	307	420	CHIC.	P
116	NEEDVILLE, CITY OF	85	35	50	-31	311	429	CHIC.	P
134	ROSENBERG, CITY OF	100	25	75	-62	545	840	CHIC.	P
135	ROSENBERG, CITY OF	100	-40	140	-57	644	979	EVANG.	P
136	ROSENBERG, CITY OF	100	-40	140	-57	970	1,594	EVANG.	P
137	ROSENBERG, CITY OF	100	-40	140	-57	810	1,310	EVANG.	P
138	ROSENBERG, CITY OF	100	-55	155	-69	950	1,580	EVANG.	P
139	SUGAR LAND, CITY OF	70	-200	270	-140	0	1,665	EVANG.	P
140	SUGAR LAND, CITY OF	70	-200	270	-140	510	1,202	EVANG.	P
141	SUGAR LAND, CITY OF	70	-200	270	-140	605	995	EVANG.	P
142	SUGAR LAND, CITY OF	70	-200	270	-140	549	900	EVANG.	P
143	SUGAR LAND, CITY OF	90	-200	290	-141	680	960	EVANG.	P
144	SUGAR LAND, CITY OF	90	-200	290	-141	1,320	1,775	EVANG.	P

Table VI-2 PROJECTED POTENTIOMETRIC LEVEL DECLINES IN EXISTING WELLS IN FORT BEND COUNTY

WELL	OWNER	GRD. ELEV.* (FEET)	1987 WATER ELEV.* (FT)	1987 DEPTH** TO WATER LEVEL (FEET)	2030 PROJECTED WATER LEVEL DROP (-) (FEET)	DEPTH** TO TOP OF 1ST SCREEN (FEET)	TOTAL WELL DEPTH** (FEET)	AQUIFER	WATER USE***
145	SUGAR LAND, CITY OF	75	-180	255	-132	1,182	1,810	EVANG.	P
147	CINCO M.U.D. #1	90	-5	95	-95	440	820	CHIC.	P
148	FT. BEND CO. M.U.D. 37	110	15	95	-77	570	1,022	CHIC.	P
149	FT. BEND CO. M.U.D. 47/48	70	-140	210	-107	706	1,000	EVANG.	P
150	BEASLEY, TOWN OF	95	45	50	-30	808	955	CHIC.	P
151	BEASLEY, TOWN OF	95	45	50	-30	855	975	CHIC.	P
166	WILLOWISP COUNTRY CLUB, INC.	70	-225	295	-150	0	450	EVANG.	P
167	WILLOWISP COUNTRY CLUB, INC.	70	-225	295	-150	0	504	EVANG.	P
168	WILLOWISP COUNTRY CLUB, INC.	70	-225	295	-150	0	100	EVANG.	P
169	FT. BEND CO. M.U.D. 23	65	-60	125	-109	880	1,338	CHIC.	P
170	FT. BEND CO. M.U.D. 46	70	-130	200	-104	660	1,165	EVANG.	P
171	FT. BEND CO. M.U.D. 50	110	5	105	-92	710	1,210	CHIC.	P
172	NEEDVILLE I.S.D.	70	15	55	-29	120	140	CHIC.	P
173	NEEDVILLE I.S.D.	70	15	55	-29	120	140	CHIC.	P
175	VENETIAN ESTATE PROP OWNER ASSO	70	-200	270	-140	0	0	EVANG.	P
178	FT. BEND UTILITIES CO.	75	-180	255	-132	561	775	EVANG.	P
179	FT. BEND UTILITIES CO.	75	-180	255	-132	1,287	1,570	EVANG.	P
181	FT. BEND UTILITIES CO.	75	-180	255	-132	698	1,025	EVANG.	P
202	MEADOWS M.U.D., THE	80	-215	295	-150	750	1,040	EVANG.	P
203	MEADOWS M.U.D., THE	80	-215	295	-150	710	1,035	EVANG.	P
204	KATY, CITY OF	115	15	100	-55	458	644	CHIC.	P
212	MILL BROOK WATER & SANITARY,INC.	85	25	60	-49	0	312	CHIC.	P
213	MILL BROOK WATER & SANITARY,INC.	85	25	60	-49	0	230	CHIC.	P
214	MILL BROOK WATER & SANITARY,INC.	85	25	60	-49	203	232	CHIC.	P
217	FT. BEND CO. M.U.D. 81	115	60	55	-33	326	450	CHIC.	P
218	FT. BEND CO. M.U.D. 81	115	60	55	-33	455	650	CHIC.	P
219	FT. BEND CO. M.U.D. 81	115	60	55	-33	330	450	CHIC.	P

exceeds its current need to satisfy demand.

Table VI-5 summarizes the public water demand of existing water systems in Fort Bend County, and the amount of well, storage and service pumping capacity necessary to meet minimum Texas Water Commission criteria to satisfy the population assuming a single system. As shown in Table VI-5, there is a 100 percent excess in well capacity, a 41 percent excess in storage capacity, and a 104 percent excess in service pump capacity. Some of the water production facilities in place are designed for future water demand. However, the table exemplifies some capital investments that may have been made before they were actually required.

TABLE VI-1 RADIOACTIVE CONSTITUENTS IN FORT BEND COUNTY

SAMPLING LOCATION	SAMPING DATE	SAMPLING TYPE	GROSS ALPHA (pCi/l)	GROSS BETA (pCi/l)	TOTAL RADIUM (pCi/l)	CHLORO-FORM (ug/l)	BROMO-FORM (ug/l)	BROMODI-CHLOROMETHANE (ug/l)	DIBROMO-CHLOROMETHANE (ug/l)	TOTAL THMS (ug/l)
CITY OF NEEDVILE	11/29/90	DISTRIBUTION	4.6+/-2.0	9.3+/-2.6	06.+/-0.2					
	1/30/91	DISTRIBUTION				<1.0	3.0	<1.0	1.0	
CITY OF ROSENBERG	6/17/91	DISTRIBUTION	<2.0	<4.0						
	5/14/91	DISTRIBUTION				17.0	1.0	3.0	<1.0	21.0
CITY OF RICHMOND	3/21/91	DISTRIBUTION	4.0+/-1.7	5.2+/-2.2	1.1+/-0.2					
	4/15-91	PLANT #1				3.0	<1.0	2.0	1.0	6.0
	4/15-91	PLANT #2				2.0	2.0	3.0	2.0	9.0
	4/15-91	PLANT #3				4.0	1.0	3.0	2.0	10.0
KATY FREEWAY MHP	7/15/91	DISTRIBUTION	6.3+/-1.8	5.0+/-2.1	0.9+/-0.2					
CINCO RANCH MUD NO. 1	5/3/91	DISTRIBUTION	6.4+/-1.8	<4.0	0.6+/-0.2					
	8/23/91	PLANT				<1.0	<1.0	<1.0	<1.0	

DEGRADATION OF WATER QUALITY

The groundwater in Fort Bend County is of relatively high quality and requires only disinfection before being distributed to consumers. In December, 1991, no systems from Fort Bend County were on the TDH's maximum contaminant level (MCL) violation list. Although no known problems with groundwater currently exist, possible complications may arise due to the continuing drop in potentiometric levels and stricter water quality regulations.

An area of northwest Houston recently experienced high concentrations of radioactive constituents in the groundwater pumped from the Chicot/ Evangeline aquifer system. Problems of this sort usually are caused by elevated concentrations of radioactive constituents within a localized sand layer(s) of an aquifer which then are pumped out by a nearby well(s). There is no current MCL for Radon 222. The Environmental Protection Agency is proposing to limit Radon 222 to 300 pCi/l. This proposed limit is so low that current concentrations of radon gas in existing groundwater may exceed this limit, thus posing a problem in the future for all groundwater supplies. Additional treatment, in the form of aeration or by passing the water through granular activated carbon, would be necessary to remove the radon. After investigating TDH sampling and analysis data, no apparent or related problem is present in Fort Bend County (Table VI-1).

Additional concern for future groundwater quality is caused by the existence of eight salt domes located either wholly or partially in Fort Bend County (Exhibit VI-1). These salt domes pierce the Evangeline and/or Chicot aquifers. Groundwater adjacent to salt domes typically will have a higher saline content. As groundwater withdrawal is increased, the poorer quality water near the salt domes may be increasingly drawn into the lowering cones of depression around the active wells. At the same time; higher quality groundwater will flow through and around the salt domes to replace the water flowing into the wells. Both of these factors result in small declines in water quality. Areas where intermediate sands in the Chicot aquifer contain water with more than 1000 mg/l total dissolved solids (TDS) are located around the following salt domes:

SALT DOME	CAPROCK ALTITUDE
Orchard Dome	170'
Big Creek Dome	317'
Boling Salt Dome	313'
Nash Dome	570'
Long Point Dome	475'
Blue Ridge Dome	58'

The caprock altitudes of two additional salt domes are too deep to affect either aquifer. These salt domes are the Sugar Land Dome and the Thompson Dome with caprock altitudes of 3,430 feet and 9,250 feet respectively.

INCREASE WATER PRODUCTION COSTS

The subsidence condition shown in Section VII results from a decline in potentiometer water levels in the aquifer. Exhibit VI-2 shows the projected potentiometric level declines in the aquifers in Fort Bend County, assuming that the western portion of Harris County and all of Fort Bend County continue to pump groundwater and no conversion to surface water occurs. This decline in potentiometric surface will require more horsepower to lift the water and, in many cases, may require the wells to be replaced. Data provided by the FBSD and the U.S. Geological Survey on well depths was combined with information from HGCSD on potentiometer levels and potential declines to assess how these declines will impact wells in Fort Bend County. The column entitled "1987 Depth to Water Level" on Table VI-2 was calculated by utilizing USGS topography maps and deducting the 1987 water levels as determined by the USGS to determine the water level altitudes in the Chicot and Evangeline aquifers. The projected water level drop, combined with the existing 1987 water level, was used to determine the location of the water level relative to the first well screen. If the depth to the first screen was not available, the total depth of the well was used as a guide. If the declining levels moved lower than the total depth of a particular well, it would have to be abandoned.

Declining potentiometer levels will require future well workover costs as well as new well costs to maintain existing groundwater capacity for all permitted water wells. Projected costs for public water supply wells are shown in Table VI-3 and represent both the workover costs and new well costs. Table VI-4 lists projected industrial costs in the county. Development of well costs is described below. If a projected water level elevation were lower than the top of the first screen, the well would have to be replaced. The cost of a replacement well was calculated by determining the total depth of the original well and its use. If the projected water level was found to lie above the top of the first screen, then workover costs were dependent upon incremental lowering of the pump. In some cases, workover required adding a stage or pump bowl. Wells experiencing a projected water level drop of less than 20 feet had no associated costs.

Total costs attributed to the decline in potentiometric surface were computed to reach $37 million throughout the planning period 1990-2030. The majority of the cost is due to well replacement. Of the $37 million cost, roughly $12 million will be incurred on public supply wells.

DUPLICITY IN WATER PRODUCTION FACILITIES

The current pattern of residential development in Fort Bend County relies heavily on the creation of utility districts. In most cases, tracts of land are divided into a number of different utility districts. One district then provides both water supply and wastewater treatment facilities to the entire development, but not to any entities outside the development boundaries. Each potential development, operating on its own, must make an initial investment in water production facilities, wells, plants and storage facilities that often

SECTION VI - IMPACTS OF CONTINUED GROUNDWATER WITHDRAWAL

GENERAL

The historic trend of groundwater withdrawal and resulting land subsidence in the Houston Metropolitan area has had several adverse impacts associated with it. The most notable impact has been the increase in flooding in coastal areas in eastern Harris County where land subsidence has approached 10 feet. Historic subsidence in Fort Bend County during the same period has been three feet. In formulating its most recent regulatory action plan, the HGCSD projected conditions of subsidence that would occur if all future municipal water demand in the region was supplied by groundwater. This condition predicts more than five feet of additional subsidence could occur in Fort Bend County by the year 2030.

The HGCSD, using the same information on projected water demands, has however, recently adopted a new regulatory action plan calling for timed conversion from groundwater to surface water in Harris and Galveston Counties. This plan would require Southwest Harris County to convert 80 percent of its total water production from groundwater to surface water at time intervals between 2000 and 2030. If the HGCSD plan is implemented, additional subsidence in Fort Bend County throughout the planning period 1990 to 2030 is expected to be 1 foot or less with no conversion to surface water in Fort Bend County other than in the city limits of Houston. The dramatic difference between the two conditions of subsidence accentuates the interdependence between subsidence in Fort Bend County and groundwater pumpage in Harris County.

In much the same way that HGCSD cannot regulate water use in Fort Bend County, the FBSD cannot regulate water use in Harris County. Therefore, this study assumed the "worst case" scenario of no conversion to surface water in either Fort Bend County or Southwest Harris County to evaluate the impacts of continued groundwater withdrawal for municipal water demands.

The potential for increased flooding from the Brazos River due to subsidence is a major focus in this study. and is discussed in Section VII. However, the historic trend in the Houston area indicates several additional potential impacts of continual dependence on groundwater including:

- acceleration of ground faulting
- degradation in water quality
- increased water production costs associated with declining potentiometric surfaces
- proliferation of small inefficient water systems instead of more efficient regional systems

A detailed evaluation of flooding and subsidence is contained in Section VII. The following paragraphs briefly describe these other impacts.

ACCELERATION OF FAULTING

More than 86 historically active faults have been identified in the greater Houston area. The fault scarps cover a length of more than 150 miles and range from 1 foot to 1.6 foot in height. Fault creep rates, eg. the rate of internal movement, range between 1/8 inch to 1 inch per year.

Field observations, combined with the rates of scarp height to creep ratio, indicate that most of the fault activity has occurred since 1930. The historic fault activity has been shown to be caused primarily by pumping of groundwater and the resultant declining potentiometric levels in the underlying aquifer. Pumping of groundwater is typically associated with continued land development. Consequently, development may be in place before the fault scarp movement is observed. As a consequence there have been many cases of structural damage to houses, buildings, streets, and utilities due to fault creep. Although no studies have been compiled to determine the cost of damages due to fault scarp, the damages have been extensive. On the Long Point fault alone, located in northwest Houston, more than 200 houses have been damaged. Residential damages on the Clodine fault resulted in 37 lawsuits.

There are three identified faults in Fort Bend County: The Addicks, Clodine, and Renn systems (as shown on Exhibit VI-1). All of these scarps are aligned in a northeast to southwest direction and are located in northeast Fort Bend County where population concentration is high and land is most rapidly developing. Major structural damage has been associated with the Clodine and Addicks faults in Harris County. Identification of faulting, and, therefore, damages from faulting, in Fort Bend County has been limited because of the limited groundwater production and, potentially, the salt domes that exist. As groundwater production is increased, additional faulting may be identified in the future.

Just as fault activity has accelerated due to increased pumpage of groundwater, activity has also slowed or stopped in eastern Harris County where groundwater pumpage has declined and has been replaced by surface water. Studies performed by the U.S. Geological Survey show that in areas where potentiometric levels have risen, fault creep in these areas has slowed to less than ¼ of the historic rate.

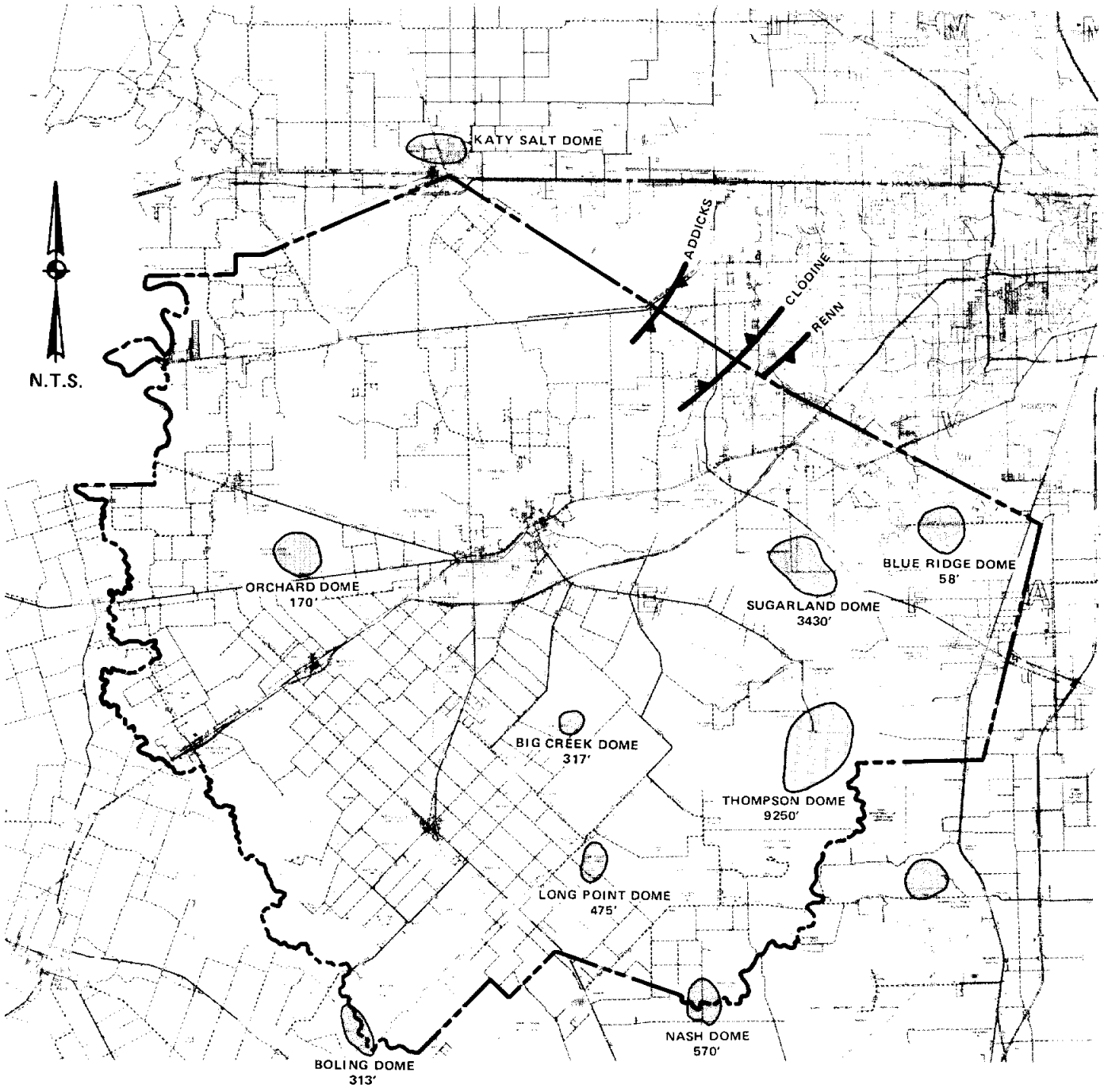


EXHIBIT VI-1

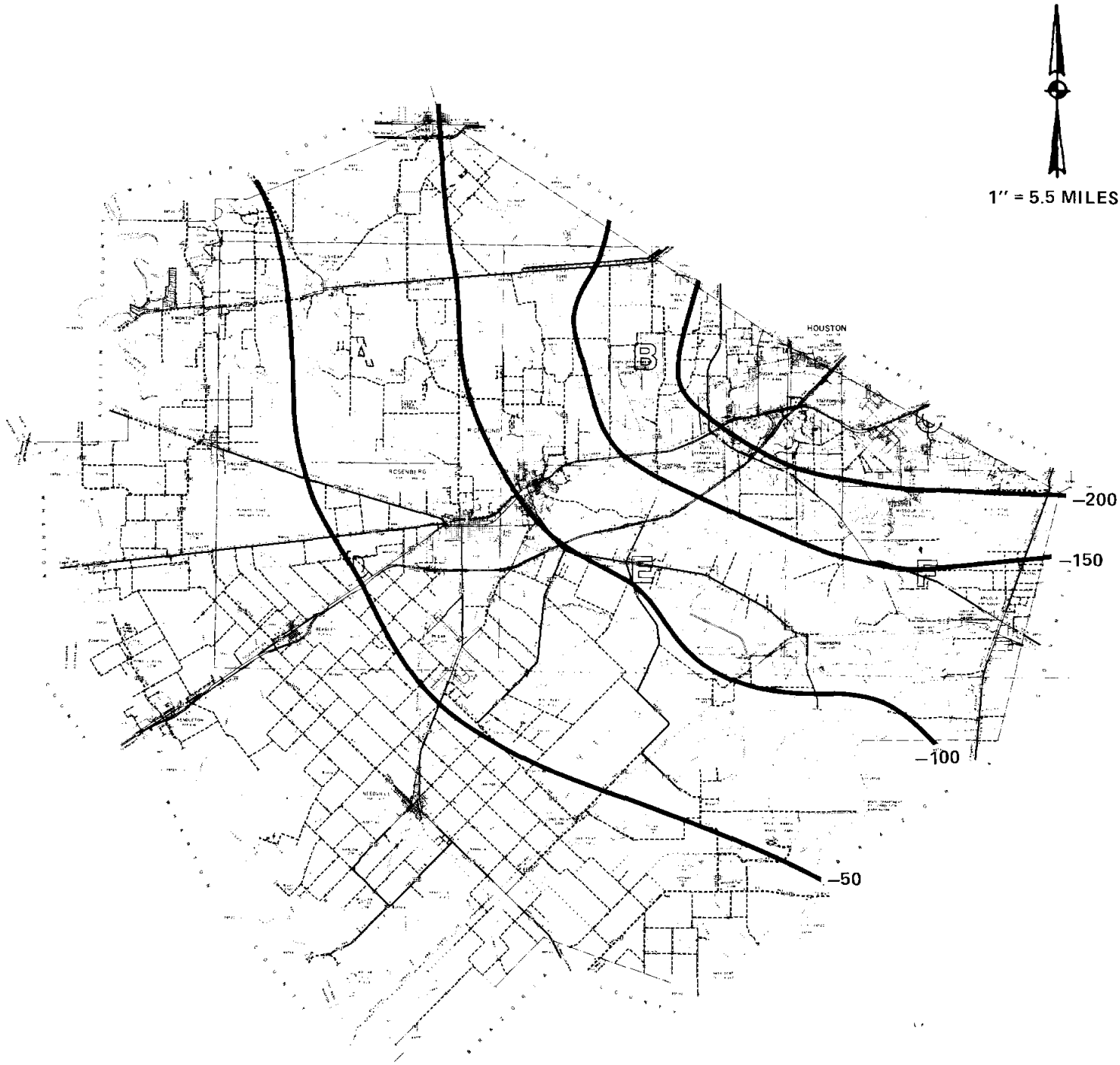
FAULTS AND SALT DOMES IN FORT BEND COUNTY

FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: JUNE 1992 JOB NO. 33-0736-1000



NOTE:
POTENTIOMETRIC LEVEL DECLINES PROJECTED ABOVE ARE BASED ON THE CONTINUED USE OF GROUNDWATER TO SUPPLY MUNICIPAL DEMANDS IN FORT BEND COUNTY AND WESTERN HARRIS COUNTY.

EXHIBIT VI-2

POTENTIOMETRIC LEVEL DECLINES IN FORT BEND COUNTY (1990 - 2030)

FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: JUNE 1992 JOB NO. 33-0736-1000

SECTION VII - EVALUATION OF SUBSIDENCE IMPACT ON FLOODING

DEVELOPMENT OF SUBSIDENCE CASES

The previous sections of this report discussed possible adverse effects of continued groundwater withdrawal on environmental conditions in Fort Bend County, the most dramatic effect being increased subsidence. The following investigation addresses the changes in flood characteristics in Fort Bend County should the worst probable condition of subsidence occur. This worst case subsidence scenario included the following assumptions: 1) Total dependence on groundwater continues for west Harris County and Fort Bend County; and 2) No further expansion of surface water treatment plant facilities occurs in the thirteen county region around the City of Houston. The HGCSD was asked to generate the "worst case" subsidence scenario for Fort Bend County by using computer models to project the maximum groundwater withdrawal and resulting subsidence for Fort Bend County and surrounding areas for a 40 year interval (present to 2030). Although the worst case scenario has a very low probability of actually occurring due to surface water conversion plans contained in the HGCSD regulatory action plan and currently being implemented in Harris County, it is a worst-case scenario which would allow evaluation of the impacts from the maximum probable subsidence. The subsidence contours resulting from this scenario are shown on Exhibit VII-1. Also shown on this exhibit is the recorded subsidence from 1943 to 1987.

The subsidence contours resulting from the proposed scenario were initially projected onto a detailed base map of Fort Bend County which showed streams, levee districts, roads, and population areas. The layout of the subsidence contours with respect to direction of drainage and stream flow was analyzed to predict which streams may be impacted by the subsidence. Due to the gradual change in amount of subsidence across most of the County, it became apparent that only two drainage systems would be significantly impacted. The Brazos River and Middle/Upper Oyster Creek are larger stream/river systems and are situated so that the direction of flow is perpendicular to or crosses the major contours of subsidence. These two systems would therefore receive an impact on flow capacity due to the change in the slope of the river/stream bed due to the non-uniform or differential subsidence.

Exhibit VII-2 schematically shows the increase in water depth in a stream where differential subsidence has occurred. Unlike in coastal areas, where the water surface remains constant as the land surface subsides, thus increasing the depth of flooding equal to the amount of subsidence, in inland areas, depth of increased flooding does not increase equal to the level of subsidence since the water level generally subsides along with the land surface. As can be seen in Exhibit VII-2, the "bowling" effect of differential subsidence on the channel causes the channel slope downstream of the point of maximum subsidence to decrease, while the

upstream slope increases. Water flow is slowed near the "bowl" and water depth increases, although the increase does not equal the depth of subsidence. The other stream systems in Fort Bend County, besides the Brazos River and Oyster Creek, are located for the most part parallel to the subsidence contours (did not cross the contour lines) and therefore were not affected by differential subsidence along their length. The Brazos River and the Oyster Creek System were analyzed further to determine the impact of the "worst case" subsidence scenario on flood conditions in each watershed.

ANALYSIS OF SUBSIDENCE USING HEC-2

The U.S. Army Corps of Engineers' HEC-2 hydraulic computer program was used to analyze the effects of the "worst case" subsidence scenario on flooding in Fort Bend County. The model is made-up of a series of cross sections which define horizontal locations along a stream system and corresponding elevations. These cross sections are spaced at specific intervals along the length of the stream. Information on structures which cross the stream, such as culverts, pipelines, or bridges, is also coded into the model. Additional information including the stream flow, channel roughness factors, and other required data is used in the model to accurately predict the water surface elevations in the channel and adjacent overbanks for any given flood flow event. In the analysis described herein, the model cross-sections were adjusted to reflect the lowering of the ground surface resulting from the subsidence scenario. The resulting flood depth was then compared to current conditions. The specific methodology used to analyze each watershed was slightly different and is discussed in detail below.

Middle Oyster Creek

The base HEC-2 model for Middle Oyster Creek was obtained from the Fort Bend County Drainage District. The model reflects ongoing improvements designed for Middle Oyster Creek from the mouth of Flat Bank Creek to upstream of Lexington Boulevard. Exhibit VII-1 shows the location of the Oyster Creek system in relation to the subsidence contours.

To analyze the impacts on the water surface elevations in Middle Oyster Creek from the previously described subsidence scenario, the cross sections in the HEC-2 model were altered. The overbank ground and channel elevations on each individual section were lowered uniformly to reflect the specific change in elevation due to subsidence at the midpoint of the channel at the individual section. The first step involved updating the base model from its original datum adjustment for the year 1978 to the latest subsidence datum adjustment, for 1987. This step resulted in what is considered to be the "existing condition" model for the stream. A second step was then performed which revised the new model to a 2030 datum adjustment based on the subsidence projections discussed previously. This step resulted in the model for projected "future" conditions.

Flows based on the 100-year flood event (an event which has a one percent chance of occurring in any given year) were input into both the "existing condition" and future condition models. The maximum change in channel elevation due to subsidence was 4.55 feet at the upper end of Middle Oyster Creek. The maximum increase in depth of water in the channel was 0.57 feet between Cartwright and Dulles Avenue; however, the 100-year flows were still within the banks of the channel of Middle Oyster Creek. More frequent flood events (10-year and 25-year events) produced similar results with even less change in water surface elevations. The projected worst case subsidence scenario had no significant impact on flooding conditions in the Oyster Creek system, therefore the results of the Oyster Creek analysis were not used in any further evaluation of potential damages from subsidence.

Brazos River

The Brazos River flows from north-central Texas to the Gulf of Mexico and bisects Fort Bend County flowing generally from northwest to southeast through the county. In order to accurately model the effects of subsidence on the flooding characteristics of the river, three HEC-2 models were obtained and combined. Table VII-1 lists the models' names, source, and recorded date of last revision. No datum adjustments were noted for the Fort Bend County and Waller County models, while the Brazoria County model had a 1979 datum adjustment.

The first step in analyzing the effects of subsidence on Brazos River flooding was to combine the three models and convert the single HEC-2 model to a 1987 datum adjustment for subsidence. FBCSD provided a map of recorded subsidence in Fort Bend County for the 1943 to 1987 period. The adjustment for the period from 1979 to 1987 was developed from other data. Initially, the subsidence at the midpoint of the channel for each cross section was used to lower all the elevations on that cross section uniformly, as was done on the Middle Oyster Creek model. However, the cross section lengths, the relatively sharp turns in the river, and the proximity of the subsidence contours indicated that the effects of subsidence would be more accurately simulated by the model if the predicted changes in the subsidence adjustment along each cross section were modeled. Therefore, every cross section was plotted on a map and the differential subsidence along each section was noted and coded into the model resulting in an "existing condition" model. This, in effect, "tilted" some cross sections and "bowled" others. The second step in the analysis repeated the process described above, but added the projected subsidence in Fort Bend County for the period from 1987 to 2030. The cross sections were again modified along their entire lengths in order to simulate the river crossing and recrossing the subsidence contours as it meanders across the County. As the river and surrounding areas "sink" differentially due to the projected subsidence, the slope of the river bed flattens downstream of the point of maximum subsidence and steepens upstream of this point as shown schematically on Exhibit VII-2. This causes a bowl effect near the point of maximum subsidence

which has a tendency to increase the flooding potential in this area. The area of maximum subsidence along the Brazos River is located south of the City of Sugar Land near the U.S. 59 bridge, as shown in Exhibit VII-1.

The existing and projected condition models were then run for the 100-year flow condition. The 100-year flow at the USGS gaging station at Richmond used in the models is 181,000 cfs. The resulting maximum increase in the depth of flooding for the 100-year event was 1.2 feet in the vicinity of U.S. 59. Table VII-2 summarizes the changes in depth of flooding along the entire length of the Brazos River in Fort Bend County. As can be seen from the table, in western Fort Bend County (upstream from Rosenberg-Richmond) depths of flooding actually decrease slightly due to the increase in slope. Downstream of the Rosenberg-Richmond area, the slope is decreased, the flow in the river slows down due to the change in slope and water surface elevations and depth of flooding rise.

The third step in the analysis of subsidence on the Brazos River was to run the two models for the 10-year and 25-year flood events. The results are also shown on Table VII-2. In December 1991 - January 1992, a major flood event occurred on the Brazos River which was recorded by the U.S. Geological Survey at several gages. This flood event was nearly equivalent to the 10-year flood flow and was used to analyze the Brazos River flood changes due to subsidence.

The flows in the Brazos River during the December 1991 flood were recorded at two locations by U.S. Geological Survey gages at Richmond and Rosharon and were used to model the December flood. The measured flow at the Richmond gage was 92,300 cfs. The adjustments to the model due to subsidence were input into the model as described above and the HEC-2 model was then used to predict changes in water surface elevations and depth of flooding if the December flood were to occur again in the year 2030 after the County had experienced the "worst-case" subsidence scenario.

The maximum increase in depth of flooding for the December event under the subsidence scenario projected to 2030 was 1.6 feet in the vicinity of U.S. 59.

The most dramatic effects of this increase in flood levels and increases in the 100-year flood levels would be seen in northeastern portions of the county along the river downstream of Richmond where population levels are expected to increase. A preliminary damage analysis was performed to try to quantify the potential monetary effects of the projected increased flooding in this area and is summarized in the following section.

IDENTIFICATION OF POTENTIAL DAMAGES

One of the goals of the study was to compare the flood damage costs resulting from Brazos River flooding for both existing conditions in 1991 and projected conditions in 2030. The projected conditions reflect the projected land subsidence discussed previously. For this comparison the damage costs were analyzed for each one foot increase in flood water depth ranging from the 2-year flood frequency (bank full conditions) to the 100-year flood frequency. The damage costs are based on information gathered after the December, 1991 flood, which is estimated to have a 10-year frequency. Data was extrapolated to the 100-year event by comparing flood plains and water depths with specific areas on the maps shown on Exhibits VII-3, VII-4, VII-5 and VII-6.

To perform the damage analysis, the Brazos River study reach was divided into eight segments beginning at River Mile (RM) 55.32 and ending at RM 94.98. No analyses were performed upstream of RM 94.98 because the adverse impact of subsidence above that mile point is negligible, as described previously. The acreage and number of structures subject to inundation by flood water from both the 10-year and 100-year flood events for existing conditions were determined by categories: (1) residential, (2) agricultural, and (3) open. These quantities were determined by mapping the 10-year and 100-year flood on current aerial photographs taken during the December flood and then tabulating the inundated area acreages and structures from the aerial photographs. These quantities are itemized per segment in Tables VII-3 and VII-4 for the 10-year and 100-year flood events respectively. Also included in Tables VII-3 and VII-4 are the average change in flood depths per segment for the two flood frequencies based on the projected amount of subsidence.

To generate the estimated damage costs, damage cost information obtained from various sources for the December 1991 flood was used where available. Where information was not available for the December flood, damage costs were estimated based on assumptions regarding per structure and per acre damage costs. All the damage costs assumptions are presented in Table VII-5.

Estimated average damage costs for the acreage and structure quantities described above for the existing condition 10-year and 100-year flood events were quantified per segment. Based on the two-year flood representing zero flood depth and zero damage costs and the 10-year and 100-year flood depths and their respective damage costs, flood depth vs. damage cost curves for each river segment were plotted. Based on the HEC-2 water surface profile computer program results for existing conditions, the average flood depth difference between the 2-year and 10-year flood events and between the 10-year and 100-year flood events were used to generate flood depth vs. flood frequency curves for each segment. A sample is shown in Exhibit VII-7.

With the depth-damage and depth-frequency curves described above for each respective segment, the annualized damage costs were determined for each one-foot increment of flood water depth starting at one foot above bank full conditions and ending with the overbank flood water depth for the 100-year flood event. The annualized damage costs for existing conditions are tabulated per segment in Table VII-6. The estimated total annualized damage costs for existing conditions is $18,211,300. The estimated 10-year and 100-year damage values are $10,583,530 and $21,196,300, respectively, as shown in Table VII-7.

To estimate the annualized damage costs for the projected conditions in the year 2030 a new flood depth vs. flood frequency curve for each segment was developed. The new curves were generated by increasing the flood depth for the existing condition 10-year and 100-year flood frequencies by the average change in flood depth per segment due to subsidence. Utilizing the flood depth vs. damage cost curves and the new flood depth vs. flood frequency curves described above, the annualized damage costs for projected conditions in the year 2030 were tabulated per segment, as shown in Table VII-6. The total annualized damage cost for the year 2030 is $20,637,820, or a net increase of $2,426,500 over the existing condition annualized damage cost. The estimated ten-year and 100-year damage values are $12,879,840 and $27,205,500, respectively, as shown on Table VII-7. The resulting 10-year and 100-year increases in damage due to subsidence are predicted to be $2,296,310 and $6,009,200, respectively.

In addition to the damages resulting from increased flooding, the increases in flood depth have the potential to adversely impact the flood protection capability of flood protection levees constructed to protect developed areas from flooding along the Brazos River. Specifically, the following levees were analyzed because of the potential for reduced protection due to increased flood levels:

LEVEE NAMES

1) Fort Bend County Levee Improvement District No. 7
2) Fort Bend County Levee Improvement District No. 10
3) Fort Bend County Levee Improvement District No. 11
4) Fort Bend County Levee Improvement District No. 2
5) First Colony Levee Improvement District
6) First Colony Levee Improvement District No. 2
7) Colony Bay Levee Improvement District
8) Sienna Plantation Levee Improvement District

Based on available information, it appears that these eight levees were initially constructed so that the top of the levees were at least three feet above the 100-year flood elevation in effect at the time the levee was constructed. Because of the potential increased flood depths, the freeboard, that is the amount of levee height above the 100-year design flood water, would be reduced. The amount of fill material and

associated cost to maintain the current level of freeboard protection was estimated for each of the levees listed above. The total estimated quantity of fill and associated cost to maintain the current freeboard for these levees is 424,116 cubic yards and $3,393,000, respectively.

RECOMMENDATIONS

The Phase 1 study has quantified estimated flood damages due to potential future subsidence. The average annual increase in flood damage is estimated to be approximately $2,400,000. The estimated capital cost for levee upgrading is approximately $3,400,000. Phase 2 of the study which analyzes the costs of conversion to surface water in Fort Bend County should be completed so that a comparison between these costs resulting from subsidence versus the costs of conversion to surface water may be made.

TABLE VIII - HYDRAULIC MODELS OF THE BRAZOS RIVER

Model Name	Source	Date
BRAZORIA.DAT	Brazoria County	November 1991
BRAZFLD.FBC	Fort Bend County Drainage District	December 1985
WALLER.DP.MUL.025	Espey, Huston & Assoc.	December 4, 1985

TABLE VII-2
RESULTS OF HYDRAULIC ANALYSIS OF SUBSIDENCE ON THE BRAZOS RIVER
CHANGE IN FLOOD DEPTH DUE TO SUBSIDENCE

		CURRENT CONDITIONS 1990			PROJECTED CONDITIONS 2030				
SECTION NUMBER	FLOW 10-YR 25-YR 100-YR (CFS)	FLOWLINE ELEVATION (FT)	WATER SURFACE ELEVATION (FT)	DEPTH OF WATER IN CHANNEL (FT)	FLOWLINE ELEVATION (FT)	WATER SURFACE ELEVATION (FT)	DEPTH OF WATER IN CHANNEL (FT)	DIFFERENCE IN FLOWLINE ELEVATION (FT)	DIFFERENCE IN WATER DEPTH (FT)
65.17	101000	2.75	54.96	52.21	0.70	53.08	52.38	-2.05	0.17
65.17	141000	2.75	56.21	53.46	0.70	54.30	53.60	-2.05	0.14
65.17	181000	2.75	57.42	54.67	0.70	55.49	54.79	-2.05	0.12
71.26	101000	5.45	57.90	52.45	2.65	55.83	53.18	-2.80	0.73
71.26	141000	5.45	60.23	54.78	2.65	58.10	55.45	-2.80	0.67
71.26	181000	5.45	62.10	56.65	2.65	59.88	57.23	-2.80	0.58
72.44	101000	5.90	58.63	52.73	3.16	56.47	53.31	-2.74	0.58
72.44	141000	5.90	61.15	55.25	3.16	58.93	55.77	-2.74	0.52
72.44	181000	5.90	63.14	57.24	3.16	60.84	57.68	-2.74	0.44
79.77	101000	17.99	62.45	44.46	14.80	59.82	45.02	-3.19	0.56
79.77	141000	17.99	65.00	47.01	14.80	62.28	47.48	-3.19	0.47
79.77	181000	17.99	66.78	48.79	14.80	64.05	49.25	-3.19	0.46
83.18	101000	23.17	65.78	42.61	18.74	62.77	44.03	-4.43	1.42
83.18	141000	23.17	69.26	46.09	18.74	66.11	47.37	-4.43	1.28
83.18	181000	23.17	71.69	48.52	18.74	68.42	49.68	-4.43	1.16
85.10	101000	22.70	67.43	44.73	18.01	64.17	46.16	-4.69	1.43
85.10	141000	22.70	71.29	48.59	18.01	67.83	49.82	-4.69	1.23
85.10	181000	22.70	73.99	51.29	18.01	70.46	52.45	-4.69	1.16
89.55	101000	26.28	70.32	44.04	21.90	66.60	44.70	-4.38	0.66
89.55	141000	26.28	74.24	47.96	21.90	70.42	48.52	-4.38	0.56
89.55	181000	26.28	77.14	50.86	21.90	73.19	51.29	-4.38	0.43
92.90	101000	37.64	73.68	36.04	33.60	69.82	36.22	-4.04	0.18
92.90	141000	37.64	78.34	40.70	33.60	74.40	40.80	-4.04	0.10
92.90	181000	37.64	81.88	44.24	33.60	77.85	44.25	-4.04	0.01
95.61	101000	34.22	76.20	41.98	30.42	72.29	41.87	-3.80	-0.11
95.61	141000	34.22	81.52	47.30	30.42	77.55	47.13	-3.80	-0.17
95.61	181000	34.22	85.72	51.50	30.42	81.67	51.25	-3.80	-0.25
102.10	101000	38.98	80.61	41.63	35.85	76.87	41.02	-3.13	-0.61
102.10	141000	38.98	86.80	47.82	35.85	83.06	47.21	-3.13	-0.61
102.10	181000	38.98	91.02	52.04	35.85	87.36	51.51	-3.13	-0.53
109.90	101000	45.44	84.56	39.12	42.72	82.03	39.31	-2.72	0.19
109.90	141000	45.44	90.84	45.40	42.72	88.22	45.50	-2.72	0.10
109.90	181000	45.44	94.87	49.43	42.72	92.17	49.45	-2.72	0.02
123.10	101000	62.20	96.70	34.50	60.58	94.60	34.02	-1.62	-0.48
123.10	141000	62.20	101.55	39.35	60.58	99.36	38.78	-1.62	-0.57
123.10	181000	62.20	105.32	43.12	60.58	103.07	42.49	-1.62	-0.63
138.00	101000	67.64	109.17	41.53	66.39	107.81	41.42	-1.25	-0.11
138.00	141000	67.64	112.42	44.78	66.39	111.04	44.65	-1.25	-0.13
138.00	181000	67.64	114.44	46.80	66.39	113.06	46.67	-1.25	-0.13

NOTE: Section numbers are located on Exhibits VII-3 through VII-6 and represent river miles

TABLE VII-3 - QUANTIFICATION OF POTENTIAL FLOODING OF PROPERTY BY THE DECEMBER 1991 (10-YEAR) FLOOD
BASED ON MAX SUBSIDENCE YEAR 2030

DECEMBER 1991 FLOOD	AVERAGE DEPTH INCREASE	TOTAL ACREAGE	RESIDENTIAL ACREAGE	AGRICULTURAL ACREAGE	OPEN ACREAGE
		TOTAL STRUCTURES	STRUCTURES	STRUCTURES	STRUCTURES
1) RM 94.98 (0.1) TO RM 88.30 (1.0)	0.9'	1210			1210
		14			14
2) RM 88.30 (1.0) TO RM 86.91 (1.6)	0.6'	408			408
		4			4
3) RM 86.91 (1.6) TO RM 79.77 (1.0)	0.6'	3,586	81	975	2,530
		17	3	7	7
4) RM 79.77 (1.0) TO RM 74.66 (0.8)	0.2'	4,167	72	952	3,143
		80	32	3	45
5) RM 74.66 (0.8) TO RM 71.60 (1.6)	0.8'	2,756	46	359	2,351
		43	6	8	29
6) RM 71.60 (1.6) TO RM 68.94 (1.2)	0.4'	2,943		118	2,825
		40		1	39
7) RM 68.94 (1.2) TO RM 64.53 (0.9)	0.3'	7,407		588	6,819
		54		5	49
8) RM 64.53 (0.9) TO RM 55.32 (0.1)	0.8'	14,288		2,550	11,738
Grand Total		36,765	199	5,542	31,024
		252	41	24	187

TABLE VII-4 - QUANTIFICATION OF POTENTIAL FLOODING OF PROPERTY BY THE 100-YEAR FLOOD

EXISTING 100 YEAR EVENT	AVERAGE DEPTH INCREASE	TOTAL ACREAGE TOTAL STRUCTURES	RESIDENTIAL ACREAGE STRUCTURES	AGRICULTURAL ACREAGE STRUCTURES	OPEN ACREAGE STRUCTURES
1) RM 94.98 (-0.09) TO RM 88.30 (0.46)	0.55'	2,188		366	1,822
		47		8	39
2) RM 88.30 (0.46) TO RM 86.91 (1.06)	0.60'	1,277		56	1,221
		9			9
3) RM 86.91 (1.06) TO RM 79.77 (0.46)	0.60'	8,825	163	3,995	4,667
		116	19	42	55
4) RM 79.77 (0.46) TO RM 74.66 (0.06)	0.40'	5,206	272	1,894	3,040
		126	55	15	56
5) RM 74.66 (0.06) TO RM 71.60 (0.71)	0.65'	3,562	207	512	2,843
		124	67	7	50
6) RM 71.60 (0.71) TO RM 68.94 (0.19)	0.52'	4,167	7	362	3,798
		60	3	5	52
7) RM 68.94 (0.19) TO RM 64.53 (-0.19)	0.38'	10,379		649	9,730
		29			29
8) RM 64.53 (-0.19) TO RM 55.32 (0.13)	0.32'	22,102		2,687	19,415
		88			88
Grand Total		57,706	649	10,521	46,536
		599	144	77	378

TABLE VII-5

SUMMARY OF DAMAGE COST ASSUMPTIONS

LAND-USE	10-YEAR FLOOD DAMAGE COSTS (6)	100-YEAR FLOOD DAMAGE COSTS (6)
A. County Owned Property	$136 per acre (1)	$136 per acre (1)
B. Residential Property	$10,000 per structure (2)	$20,000 per structure (2)
C. Agricultural Property	$1,000 per structure (2) $100 per acre (3)	$3,000 per structure (2) $100 per acre (3)
D. Open Acreage	$1,000 per structure (2) $10 per acre (2)	$3,000 per structure (2) $10 per acre (2)
E. Livestock & Related Enterprises	$681 per acre (4)	$681 per acre (4)
F. Oil/Gas Field	$54 per acre (5)	$54 per acre (5)

(1) Per acre figure based on Fort Bend County estimates of property damage of $5,000,000 for the December, 1991 flood and a flood plain area of 36,765 acres.

(2) Assumed value.

(3) Based on $100 per acre value for grain sorghum/ corn.

(4) Per acre figure based on reported damages of $3,774,980 for December, 1991 flood and a flood plain area of 5,542 acres of affected property.

(5) Per acre figure based on reported damages of $365,000 for December, 1991 flood over an affected area of 6,800 acres.

(6) All costs are adjusted to 1991 dollars.

TABLE VII-6
ESTIMATED AVERAGE ANNUAL DAMAGE FROM FLOODING ON THE BRAZOS RIVER IN 1991 DOLLARS

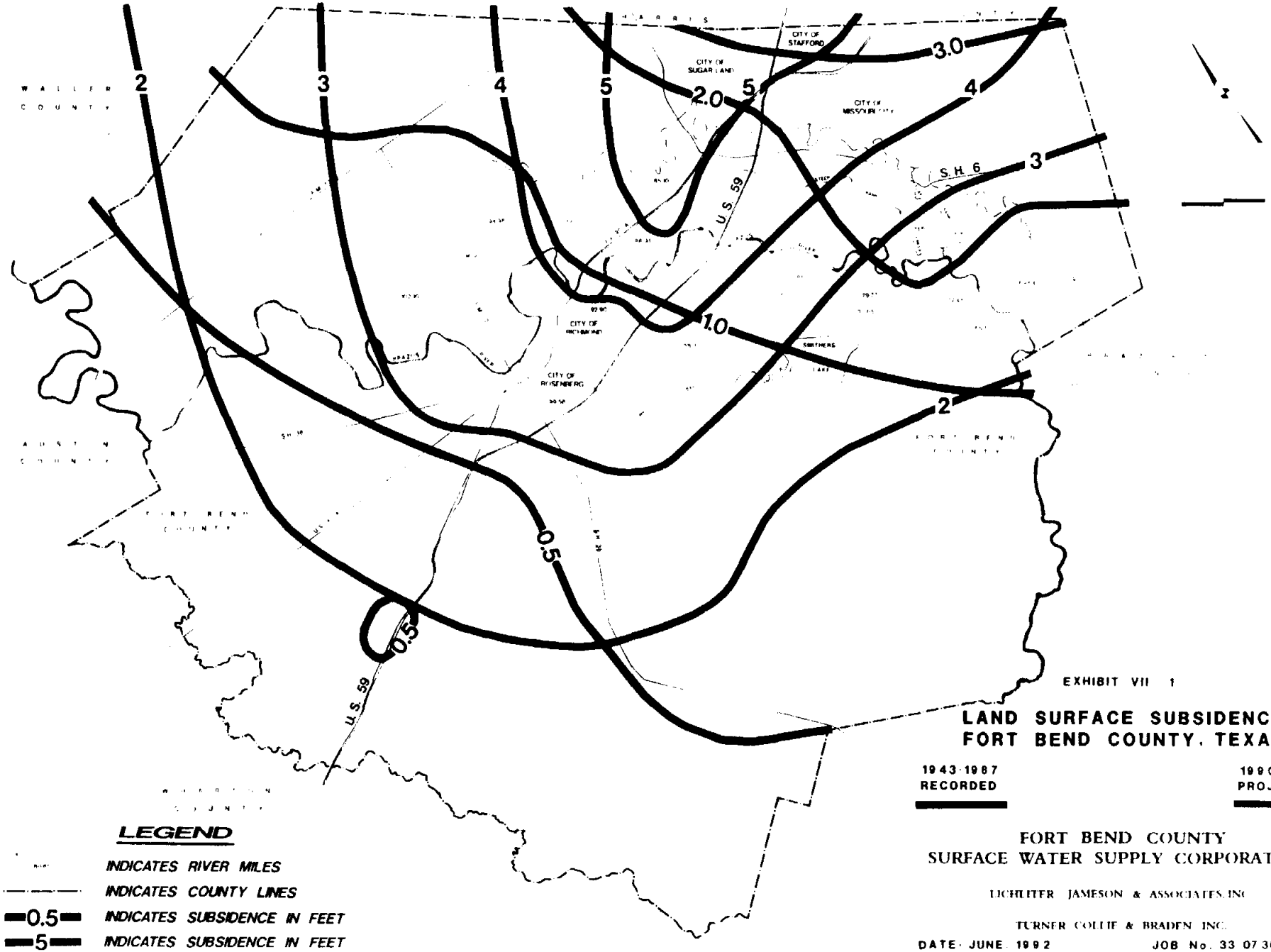
	1991	2030
SEGMENT 1	$311,260	$354,250
SEGMENT 2	101,810	126,590
SEGMENT 3	2,056,870	2,664,140
SEGMENT 4	2,609,690	3,010,080
SEGMENT 5	1,348,410	1,607,730
SEGMENT 6	953,250	1,120,310
SEGMENT 7	3,510,890	3,906,330
SEGMENT 8	7,319,140	7,848,390
TOTAL DAMAGE	$18,211,230	$20,637,820

TABLE VII-7 - ESTIMATED TOTAL DAMAGE COST FOR THE 10-YEAR & 100-YEAR FLOOD EVENTS ON THE BRAZOS RIVER IN 1991 DOLLARS

	1991		2030	
SEGMENT NO.	10-YEAR	100-YEAR	10-YEAR	100-YEAR
1	$200,890	$749,500	$225,200	$777,100
2	63,600	253,900	96,560	279,700
3	1,383,700	4,907,400	2,140,700	5,299,000
4	1.701,470	3,522,200	2,074,530	3,742,400
5	780,080	2,405,000	1,111,150	2,732,700
6	560,700	1,121,100	709,200	1,255,100
7	1,977,000	2,674,600	2,209,600	5,994,800
8	3,916,090	5,562,600	4,312,900	7,124,700
TOTALS	$10,583,530	$21,196,300	$12,879,840	$27,205,500

TABLE VII-8 EXAMPLE OF DAMAGE-FREQUENCY CALCULATIONS FOR AN INDIVIDUAL SEGMENT

RANGE OF DEPTH	AVERAGE DAMAGE $ IN 1991 $	PROBABILITY OF FLOW IN INTERVAL		ANNUAL DAMAGE IN 1991 $	
		EXISTING	2030	EXISTING	2030
0.5-1.5	$191,000	0.1	0.245	$19,100	$46,795
1.5 - 2.5	290,000	0.048	0.092	13,920	26,680
2.5 - 3.5	370,000	0.031	0.052	11,470	19,240
3.5 - 4.5	440,000	0.023	0.034	10,120	14,960
4.5 - 5.5	510,000	0.0185	0.025	9,435	12,750
5.5 - 6.5	580,000	0.015	0.0195	8,700	11,310
6.5 - 7.5	640,000	0.013	0.0155	8,320	9,920
7.5 - 8.5	690,000	0.0112	0.0128	7,728	8,832
8.5 - 9.5	743,000	0.01	0.0107	7,430	7,950
				$96,223	$158,437



LEGEND

INDICATES RIVER MILES

INDICATES COUNTY LINES

0.5 INDICATES SUBSIDENCE IN FEET

5 INDICATES SUBSIDENCE IN FEET

EXHIBIT VII 1

LAND SURFACE SUBSIDENCE FORT BEND COUNTY, TEXAS

1943-1987 RECORDED

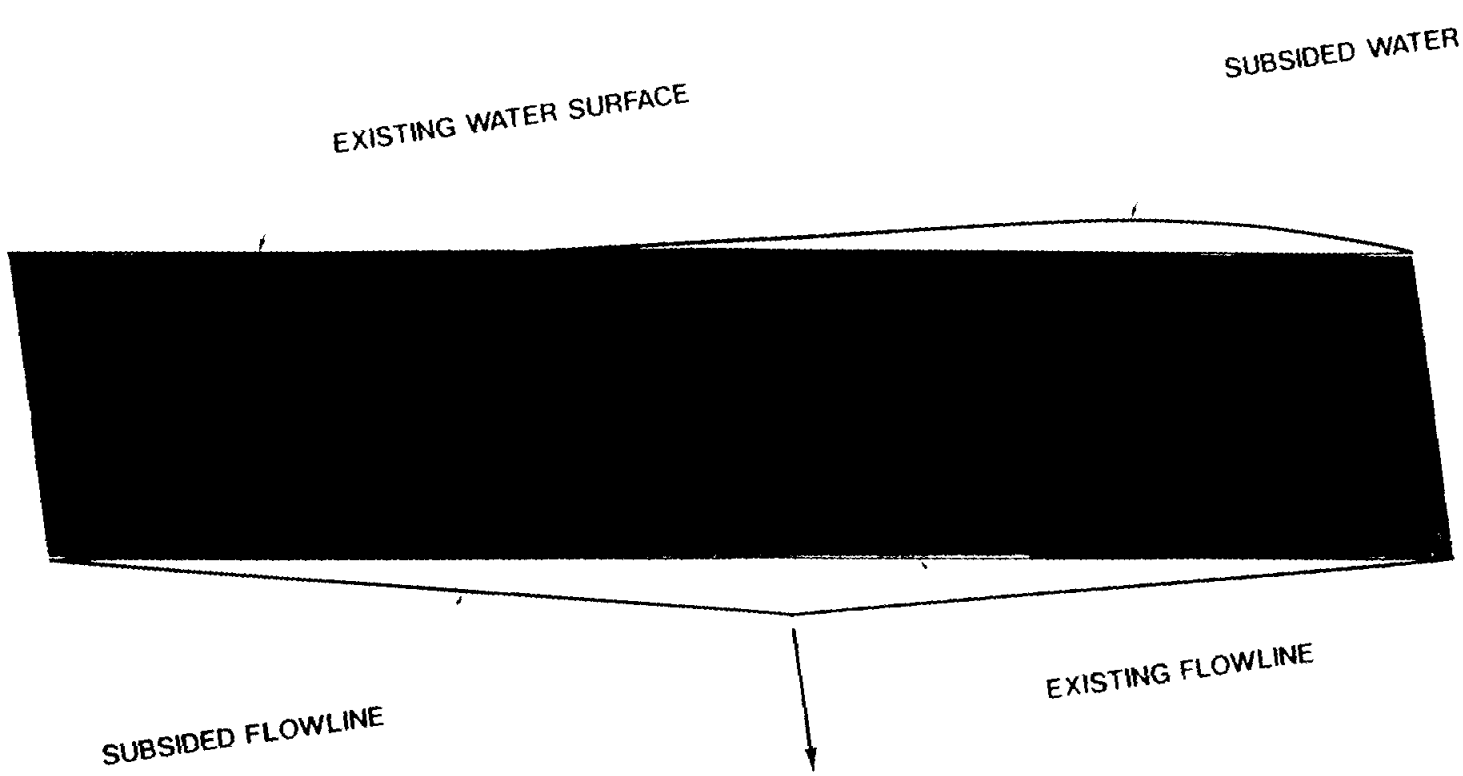
1990-2030 PROJECTED

FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

LICHLITER JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: JUNE 1992 JOB No. 33 07 36 1000



PROFILE

EXHIBIT VII 2

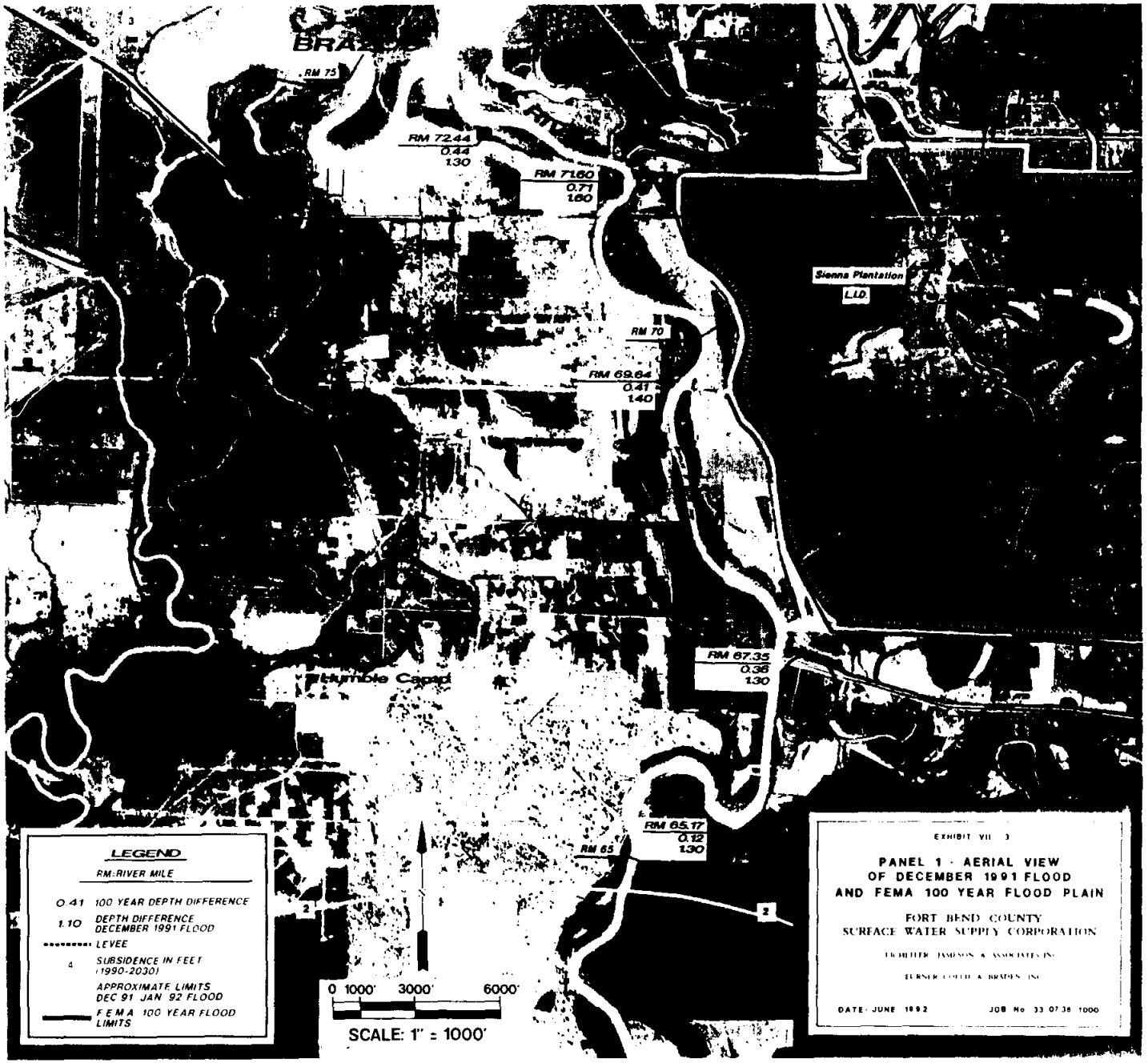
TYPICAL STREAM IMPACT OF SUBSIDENCE

FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

[illegible]

DATE JUNE 1992

JOB NO. [illegible]


RM 75
RM 72.44
0.44
1.30
RM 71.60
0.71
1.60
Sienna Plantation
L.I.D.
RM 70
RM 69.64
0.41
1.40
RM 67.35
0.36
1.30
Stumble Cape
RM 65.17
0.12
1.30
RM 65
LEGEND
RM: RIVER MILE
0.41 100 YEAR DEPTH DIFFERENCE
1.10 DEPTH DIFFERENCE DECEMBER 1991 FLOOD
LEVEE
4 SUBSIDENCE IN FEET (1990-2030)
APPROXIMATE LIMITS DEC 91 JAN 92 FLOOD
FEMA 100 YEAR FLOOD LIMITS
0 1000' 3000' 6000'
SCALE: 1" = 1000'
EXHIBIT VII 3
PANEL 1 - AERIAL VIEW
OF DECEMBER 1991 FLOOD
AND FEMA 100 YEAR FLOOD PLAIN
FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION
DATE: JUNE 1992
JOB No 33 07 36 1000

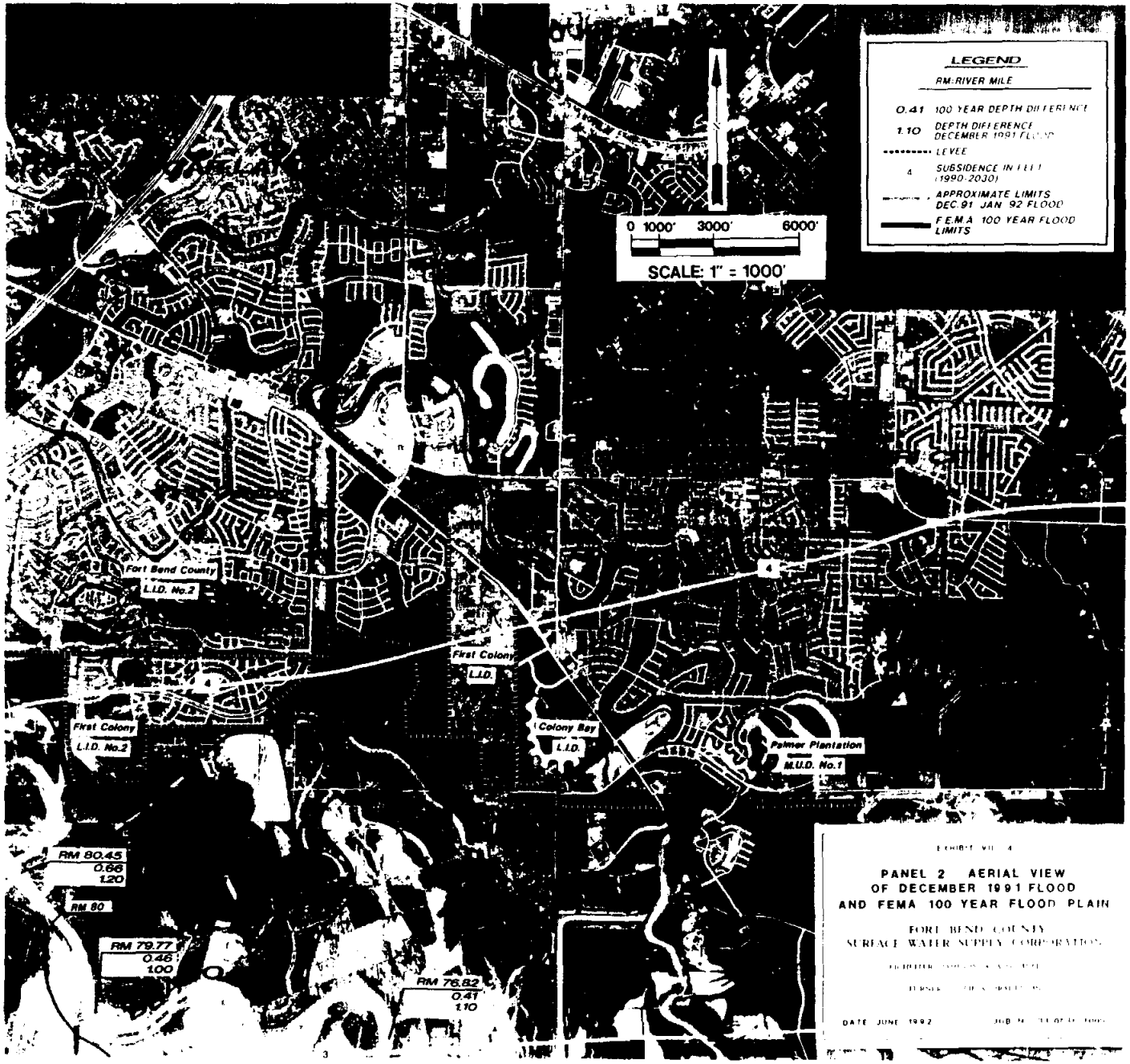
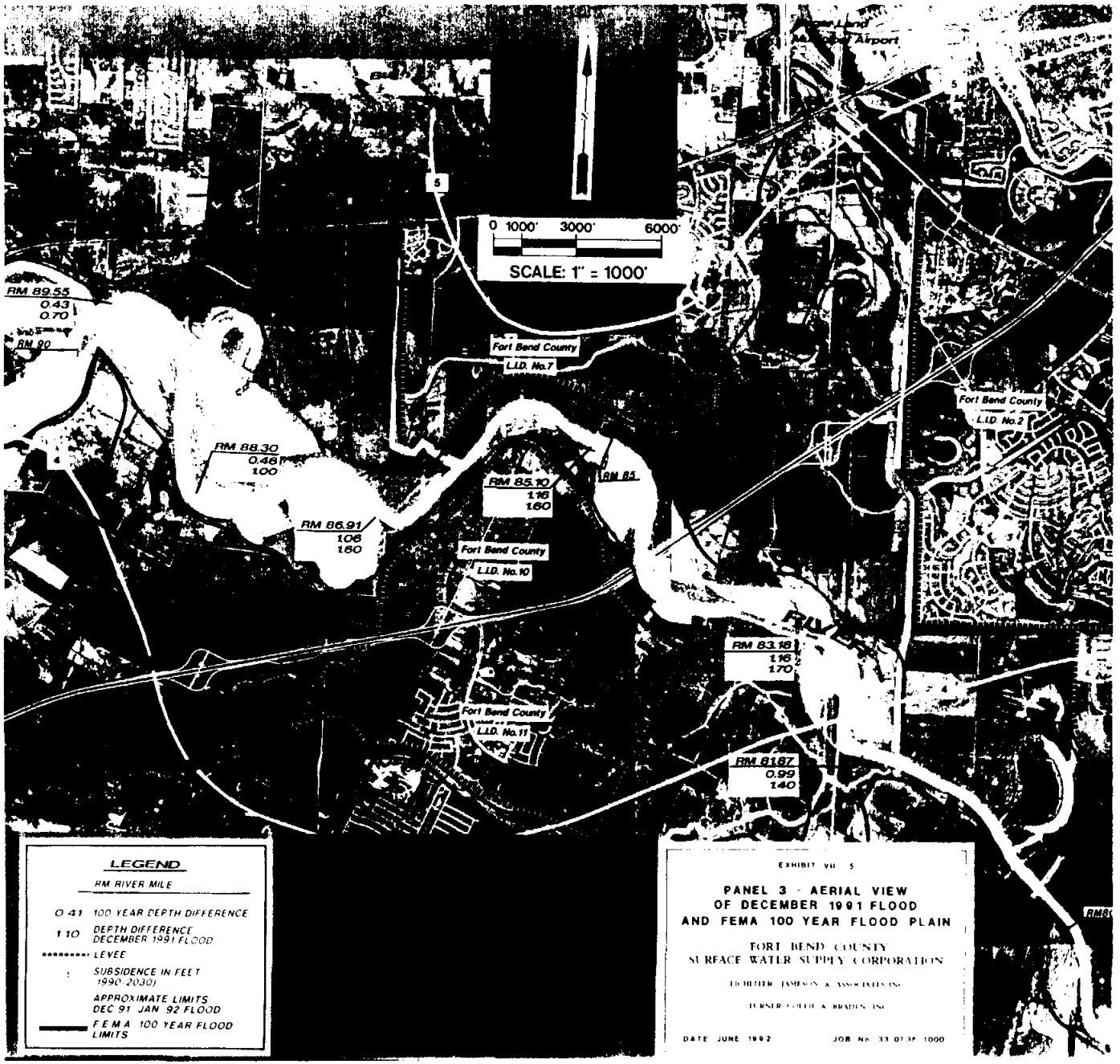


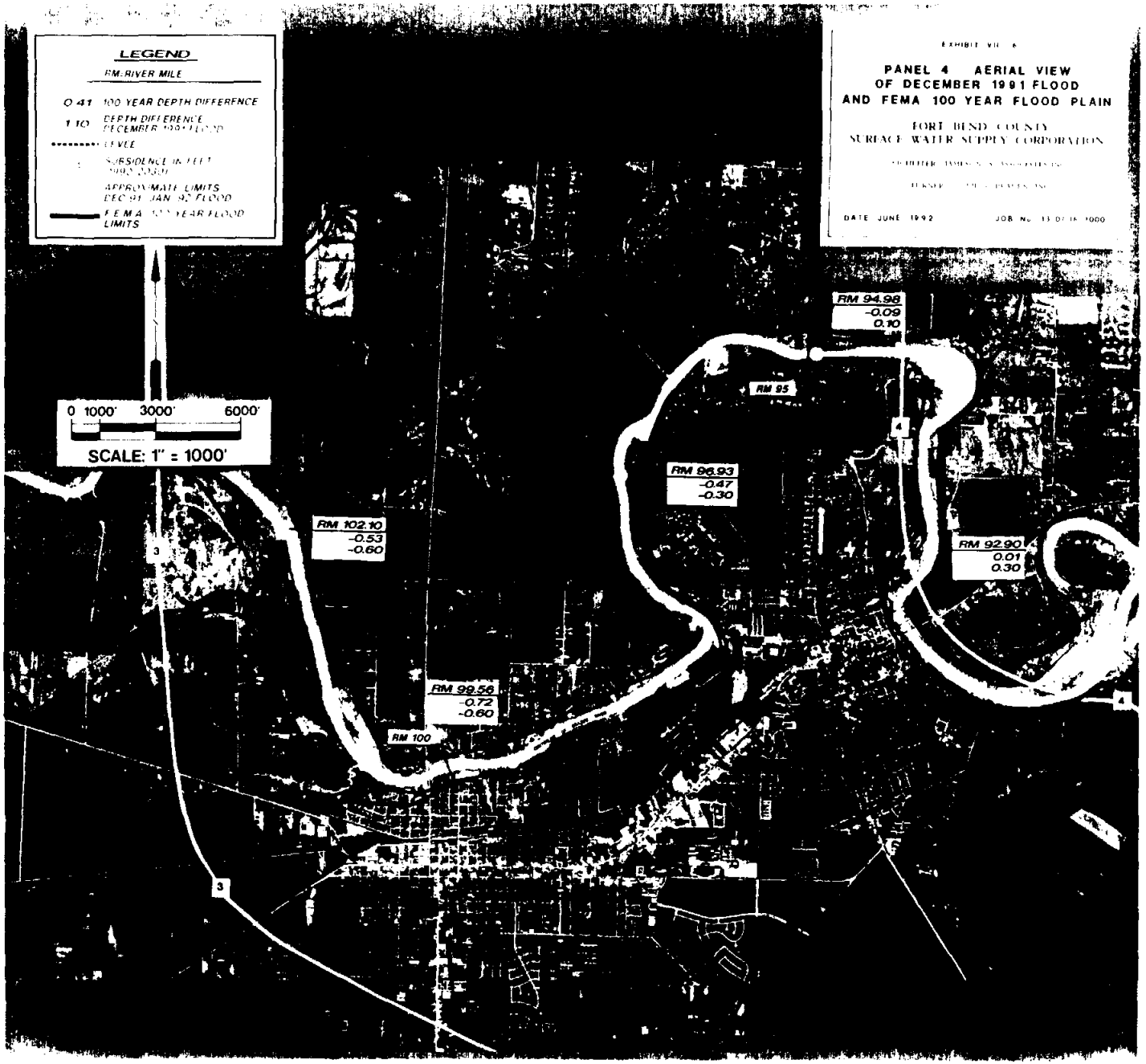
EXHIBIT VII-4

PANEL 2 AERIAL VIEW OF DECEMBER 1991 FLOOD AND FEMA 100 YEAR FLOOD PLAIN

FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

DATE JUNE 1992


0 1000' 3000' 6000'
SCALE: 1" = 1000'
RM 89.55
0.43
0.70
RM 90
Fort Bend County
L.I.D. No.7
Fort Bend County
L.I.D. No.2
RM 88.30
0.46
100
RM 85.10
116
160
RM 85
RM 86.91
106
160
Fort Bend County
L.I.D. No.10
RM 83.18
116
170
Fort Bend County
L.I.D. No.11
RM 81.87
0.99
140
LEGEND
RM RIVER MILE
0.41 100 YEAR DEPTH DIFFERENCE
1.10 DEPTH DIFFERENCE DECEMBER 1991 FLOOD
LEVEE
SUBSIDENCE IN FEET 1990-2030
APPROXIMATE LIMITS DEC 91 JAN 92 FLOOD
FEMA 100 YEAR FLOOD LIMITS
EXHIBIT VII 5
PANEL 3 - AERIAL VIEW
OF DECEMBER 1991 FLOOD
AND FEMA 100 YEAR FLOOD PLAIN
FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION
DATE JUNE 1992
JOB No. 33 07 38 1000


LEGEND
RM=RIVER MILE
0.41 100 YEAR DEPTH DIFFERENCE
1.10 DEPTH DIFFERENCE DECEMBER 1991 FLOOD
LEVEE
SUBSIDENCE IN FEET 1985-1990
APPROXIMATE LIMITS DEC 91 JAN 92 FLOOD
F.E.M.A. 100 YEAR FLOOD LIMITS
0 1000' 3000' 6000'
SCALE: 1" = 1000'
EXHIBIT VII - 4
PANEL 4 AERIAL VIEW OF DECEMBER 1991 FLOOD AND FEMA 100 YEAR FLOOD PLAIN
FORT BEND COUNTY SURFACE WATER SUPPLY CORPORATION
DATE JUNE 1992
RM 94.98
-0.09
0.10
RM 95
RM 96.93
-0.47
-0.30
RM 92.90
0.01
0.30
RM 102.10
-0.53
-0.60
RM 99.56
-0.72
-0.60
RM 100
3
4

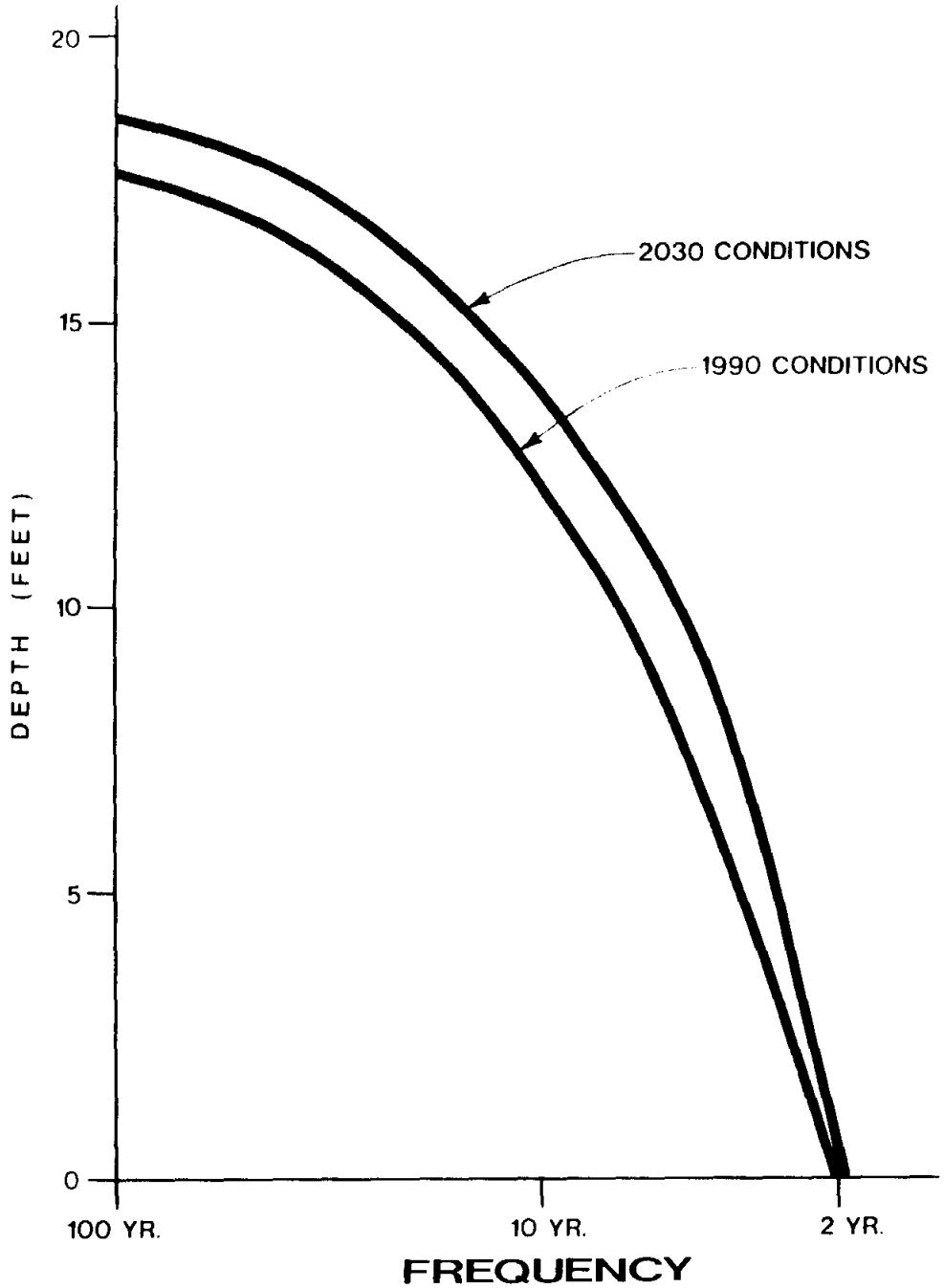


EXHIBIT VII-7

DEPTH - FREQUENCY CURVE

FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

[illegible] JAMESON & ASSOCIATES INC

[illegible] & BRADEN, INC

DATE JUNE 1992 JOB No. 33 07 36 1000

SECTION VIII - SUMMARY AND CONCLUSIONS

The following paragraphs summarize the major conclusions of the Phase 1 study.

Water Demand and Supply Sources

In 1990, 225,421 persons lived in Fort Bend County and a total of 62.5 million gallons per day (mgd) of groundwater was produced. This population represented an increase of 72% over the 1980 population of 130,846 persons. The population of Fort Bend County is expected to grow to three times the 1990 population, or 680,000 persons by the year 2030. This population correlates to a municipal water demand for the entire county of 112 million gallons per day.

Potentiometric levels in the Evangeline aquifer, which is the aquifer predominantly used for public water supply, dropped between 25 feet in the northwestern area of the county to 125 feet in the highly populated northeastern corner for the time period between 1969 and 1986. If groundwater is expected to continue as the sole source of water supply, water levels in the Evangeline are estimated to decline as much as an additional 200 feet by the year 2030. These projected declines assume no conversion to surface water in either Fort Bend or Western Harris County during the study period.

Subsidence

Due to the water level decline in the aquifer, 65 percent of the County subsided approximately 0.5 feet between the years 1947 and 1987. Five percent of the county, generally located north of the Brazos River and east of F.M. 1093, subsided more than two feet. This area is the most susceptible to future subsidence because of the large water level declines and the thick, compressible clays in the underlying aquifers. It is also expected to experience the greatest growth in population and water demand.

The Harris-Galveston Coastal Subsidence District has predicted subsidence amounts of up to eight feet in the same area of northeastern Fort Bend County for the period from 1947 to 2030. This prediction assumes that groundwater continues as the only source of water in Fort Bend County and that Harris County makes no additional conversion to surface water, which is a "worst case" assumption regarding future groundwater usage and subsidence.

Impacts on Flooding

Potential effects of this "worst case" subsidence on flooding in Fort Bend County were simulated by using the known subsidence for the period of 1947 to 1990 and projecting future subsidence for the period 1990 to 2030 with the hydraulic computer models used to determine the regulatory flood plains of major streams in the county.

Due to the locations of the subsidence contours and the existing channel capacities, significant changes in flooding due to subsidence are predicted to occur along the Brazos River. Other streams in the county do not appear to be impacted adversely. Predicted increases in flooding due to subsidence through the year 2030 range up to approximately 1.2 feet for the 100-year event and exceed 1.6 feet for the December, 1991 flood if it recurred in 2030. Increases in flooding ranging up to these values occur in the area of the river generally downstream of Richmond in the vicinity of Sugar Land and Missouri City.

Associated with an increase in depth of flooding is an increase in flood damages and a change in frequency of recurrence of any given depth of flooding. The relationships between flood frequency, flood depth and flood damages were developed by analyzing the damages resulting from the December flood and by extrapolating these damages to other flood frequencies. The resulting average annual increase in flood damage due to the projected subsidence to the year 2030 currently is estimated to be approximately $2,400,000 million. Flood damages for the ten-year and 100-year frequency are expected to increase by $2,300,000 and $6,000,000, respectively due to the "worst case" subsidence projection. In addition, to maintain current levels of production for existing levee systems, levee improvement costs totalling $3,393,000 would be required.

Other Impacts

The historic use of groundwater and the resulting declines in water levels and increased subsidence in the area have been associated with the following impacts in addition to increased flooding:

- Land subsidence has direct correlation to acceleration of ground faults. Three active faults have been identified in northeast Fort Bend County. This is the area of Fort Bend County which is projected to experience the most development in the planning period, 1990-2030.
- Declining water levels in the aquifer could result in deterioration of water quality. No indication of deterioration has been identified to date. However, groundwater movement in the vicinity of the eight salt domes in Fort Bend County may become a factor limiting groundwater withdrawal in areas near these salt domes.

- Lowering of water levels results in higher costs of water production, in terms of both energy costs, well replacement costs and increased maintenance costs.
- Current proliferation of small operating entities results in construction of water system facilities that exceed the total system demand, translating into higher costs of operation.

SECTION IX - REFERENCES

(1) Turner Collie & Braden, 1991, "A Regional Water Supply Planning Study," for the Harris-Galveston Coastal Subsidence District.

(2) Locke, G.L., 1990, "Ground-Water Withdrawals, Water-Level Changes, Land-Surface Subsidence, and Ground-Water Quality in Fort Bend County, Texas, 1969-87," USGS Water-Resources Investigations Report 90-4012, 155p.

(3) Crouch, J.C., 1992, Houston sales manager for Layne-Western Company, costs given through verbal communication.Increases in the number of wells pumping water from the aquifers has caused an increased decline in water levels of each aquifer. In the upper unit of the Chicot, water levels declined approximately 17 feet between the years 1968 and 1987. During the same period in the lower unit of the Chicot aquifer, water levels declined less than ten feet in the western part of the county to 100 feet in the northeast. Declines in the Evangeline aquifer ranged from less than 25 feet in the northwestern corner of the county to 125 feet in the northeast from 1968 to 1987. If similar rates of decline continue or increase, problems in water quality may occur.

(4) "A Regional Water Supply Planning Study, Final Report", Turner Collie & Braden Inc in association with William F. Guyton Associates, Inc., March 1991.

(5) "Regional Water Supply and Planning Study, Fort Bend County Water Control and Improvement District 2 and City of Sugar Land", Jones & Carter/Pate Engineers, August 1988.

(6) "Regional Water Supply Study, City of Rosenberg; Dickinson and surrounding areas", Dannenbaum Engineering Corporation, August 1989.

(7) "Comprehensive Plan, Regional Water Supply and Wastewater Treatment Facilities, Brazos Bend Water Authority Draft Issue", Lockwood, Andrews & Newnam, Inc. Walsh Engineering, Inc., July 1989.

(8) "West Harris County Surface Water Supply Corporation, Implementation Plan", Dannenbaum Engineering Corporation, November 1988.

(9) "Ground Water Protection and Management Strategies for Fort Bend County, Final Report," John Austin Williamson, Texas Water Commission, March 1990.

(10) "Ground Water Withdrawals, Water-Level Changes, Land-Surface Subsidence, and Ground Water Quality, Fort Bend County, Texas, 1969-87", U.S. Geological Survey, Water-Resources Investigations Report, 1990.

(11) "Ground-Water Resources of Fort Bend County", Texas Water Development Board, Report 155.

(12) "Houston Water Master Plan", Metcalf & Eddy, May 1986.

(13) "Comprehensive Listing of Water Systems in Fort Bend County", Texas Department of Health, December, 1991.

(14) "Public System Water Quality in Fort Bend County", Texas Department of Health, 1990.

(15) "Active Water Rights for Municipal or Industrial Use in Fort Bend County", Texas Water Commission, December 1991.

(16) Representative Information on Fort Bend Utility Districts, ECO Resources, Inc., December 1991.

(15) "Active Water Rights for Municipal or Industrial Use in Fort Bend County", Texas Water Commission, December 1991.

(16) Representative Information on Fort Bend Utility Districts, ECO Resources, Inc., December 1991.

FORT BEND COUNTY
REGIONAL WATER SUPPLY PLANNING
GRANT APPLICATION

Submitted to:

Texas Water Development Board

Submitted by:

The County of Fort Bend

Assisted by:

Lichliter/Jameson & Associates, Inc.
and
Turner, Collie & Braden, Inc.

November, 1990

Office of
JODIE E. STAVINOHA
County Judge

P. O. Box 368
Richmond, Texas 77469
(713) 342-3411

STATE OF TEXAS **COUNTY OF FORT BEND**

November 7, 1990

Mr. G. E. Kretzschmar
Executive Administrator
Texas Water Development Board
P.O. Box 13231
Capitol Station
Austin, Texas 78711-3231

Re: Request for Proposals
Regional Water Supply and Wastewater Planning Grants

Dear Mr. Kretzschmar:

Pursuant to the referenced request for proposal published in the Texas Register on October 22, 1990, the County of Fort Bend is submitting the attached application for a grant to develop a Regional Water Supply Plan for the entire County. Ten copies of the application are enclosed. The County is requesting a grant from the Texas Water Development Board for $150,000. The County and other entities intend to provide the additional $150,000. matching funds for the plan.

If you have any questions concerning this application, please do not hesitate to contact Mr. Bill Jameson or Mr. David Winslow at (713) 561-5190. We appreciate your consideration of this application.

Sincerely,

Jodie E. Stavinoha

Jodie E. Stavinoha
County Judge

JES:sac

attachment

TABLE OF CONTENTS

I. PROJECT CATEGORY

Regional Water Supply	X
Regional Wastewater	
Regional Water and Wastewater	

II. GENERAL INFORMATION

A. Applicant Legal Name and Address

County of Fort Bend
P.O. Box 368
Richmond, Texas 77469

B. Applicant's Official Representatives

Judge Jodie Stavinoha	County Judge
The Honorable Bud O'Shieles	County Commissioner, Precinct No. 1
The Honorable Ben Denham	County Commissioner, Precinct No. 2
The Honorable Alton Pressley	County Commissioner, Precinct No. 3
The Honorable Bob Lutts	County Commissioner, Precinct No. 4

C. Statutes Creating Legal Authority

Chapter 412.014 Texas Local Government Code
Article 143(a) of Texas Revised Civil Statutes

D. Legal Authority Citation for Regional Facilities

1.	To Plan:	Chapter 412.014 Texas Local Government Code Article 143(a) of Texas Revised Civil Statutes
2.	To Develop:	Chapter 412.014 Texas Local Government Code Article 143(a) of Texas Revised Civil Statutes
3.	To Operate:	Chapter 412.014 Texas Local Government Code Article 143(a) of Texas Revised Civil Statutes

III. FINANCIAL INFORMATION

A. Total Project Cost

The total project cost is $300,000.

B. Local Matching Contribution

The County of Fort Bend and other parties intend to contribute $150,000 in cash.

C. Requested State Assistance

The requested State assistance is $150,000.

D. Potential Sources and Amounts of Funding for Implementation

The County of Fort Bend, as well as cities, and utility districts, are considered to be appropriate potential sources of funding for implementation of the planning study. The amount required will depend on the study results; however, these entities have the financial strength to implement a well-conceived plan if and when it is needed. Also, depending upon the results of the study, a new regional authority may be required for implementation and funding.

E. Demonstrated Need for this Project and Funds

The project is needed for several reasons as described below:

1. The potential impact of future subsidence on flooding in Fort Bend County is an important technical issue which has not been adequately addressed, although it is one of the most important questions to be answered in determining where and when conversion to surface water may be necessary.

2. Prior studies on water supply have focused on very small areas of the County. The cost of converting relatively small areas to surface water instead of looking at a regional County-wide approach has been shown to be very expensive. It is anticipated that a County-wide approach will provide a more economical solution, when and where conversion is required.

3. A County-wide approach allows the flexibility to utilize the County's ground-water resources in a more cost effective manner to reduce or possibly eliminate the future need to convert to surface water in certain areas.

The funds are needed because the money available from the project sponsor is not sufficient to adequately fund the study scope.

IV. PROJECT DESCRIPTION

A. Geographical Area for Planning

The planning area for this project coincides with the geographical boundary of Fort Bend County, in southeast Texas, as shown on Exhibit 1. The planning area encompasses approximately 876 square miles and includes the cities of Arcola, Fulshear, Kendleton, Meadows, Missouri City, Needville, Orchard, Pleak, Richmond, Rosenberg, Simonton, Stafford and Sugar Land, the towns of Beasley and Thompson, and various municipal utility districts. Portions of the cities of Houston and Katy are also within the county. The planning area is part of the Brazos River Basin.

B. Description and Assessment of Existing Facilities Serving the Planning Area.

At the present time, almost all of the domestic water needs within the Fort Bend county planning area are provided by groundwater facilities operated by various cities, towns, municipal utility districts and private well owners. Limited water from the Brazos River is used by several industrial and agricultural users. The Richmond Irrigation Company and Houston Lighting and Power Company maintain water rights permits for about 13 billion gallons per year. Also a few acres of rice are irrigated from the Brazos River through the Galveston County Water Authority (GCWA) canal system.

C. Description of Existing and Projected Problems and Needs

Fort Bend County has recognized the need to manage its water resources, especially those related to groundwater withdrawal and resulting subsidence. The County now has in place a county-wide subsidence district which is currently developing a plan to regulate groundwater withdrawal. It is anticipated that as the County continues to grow, limitations will be placed on the usage of groundwater to control subsidence and to more effectively utilize the county's groundwater resources. Technical information is needed to identify what the potential impacts of subsidence are in terms of increased flood damage, so that appropriate decisions may be made regarding the need and timing of conversion to surface water. If limitations are placed on groundwater usage, alternative supplies from surface water sources must be developed if the County is to continue to grow. A water supply technical and management plan for the entire county must be developed to identify cost-effective solutions to the current and future water needs of Fort Bend County.

D. Effect on State and Regional Planning, Development, and Operation and on Other Regional Entities and Facilities.

Several previous studies which were partially funded through the TWDB planning grants have been performed to develop plans for conversion of specific political subdivisions to surface water. These studies were performed before the Fort Bend County Subsidence District (FBCSD) was created and generally have started with the assumption that the specific subdivisions must convert to surface water and then have proceeded to develop individual plans for conversion. No analysis has been performed in these studies to determine the impact of subsidence on flooding and to determine specifically where and when conversion to surface water is necessary. These individual plans may not be the most cost-effective and economical approach to provide surface water when it is needed. Also, if a more regional approach was taken with regard to groundwater withdrawal, certain areas

that have been recommended for conversion may not need to convert to surface water at least for long periods of time. Because of these factors, it is proposed that this study be performed to address on a broader scale the question of when and where conversion to surface water should occur.

E. Scope of Work, Schedule, and Budget.

1. The scope of work for this study which includes four major tasks and associated subtasks is discussed below.

Task a. - Evaluation of Subsidence Impact on Flooding

(1) Coordinate with the FBCSD to determine what subsidence cases would be evaluated in the study. It is anticipated that the FBCSD would provide projections of subsidence at ten-year intervals through the year 2030, based on alternative assumptions regarding groundwater withdrawals in Fort Bend County and in the surrounding counties of Harris, Galveston, Montgomery and Brazoria. It is anticipated that as many as six subsidence cases would be evaluated in the work elements to follow.

(2) Based on the results of task a.(1), plot the resulting subsidence contours for the alternative cases on appropriate base maps.

(3) Identify the areas where significant subsidence is projected and determine what watersheds and stream segments appear to be significantly impacted. It is anticipated that the streams to be impacted would include the Brazos River and Oyster Creek.

(4) For the affected streams delineate the study limits required and obtain the existing Federal Emergency Management Agency (FEMA) HEC-2 hydraulic models for each stream. Review these models and update for existing conditions if necessary.

(5) Apply the HEC-2 models for updated existing conditions and for the subsidence cases identified in task a.(1) for 10-, 25- and 100-year flow conditions.

(6) Evaluate the results of task a.(5) to determine what areas may be adversely impacted due to increased flooding levels. Specific areas of concern to be analyzed include existing development areas and levees. Perform a preliminary economic analysis of the potential damages associated with the increased flooding.

(7) Based on the results of task a.(6), make recommendations concerning the need, timing, and the areas requiring conversion to surface water.

Task b. - Water Supply Technical Plan

(1) Compile and review existing studies including City of Houston Water Master Plan, HGCSD Regional Water Supply Planning Study, and water conversion studies in Fort Bend and west Harris counties.

(2) Identify all current sources of municipal or industrial water supply including owners of municipal and industrial water rights, amount of water under contract, and suppliers of surface water.

(3) In cooperation with the FBCSD and the HGCSD, identify alternative approaches for surface water conversion, if appropriate.

(4) Consult with GCWA, Brazos River Authority (BRA), San Jacinto River Authority (SJRA), and the Trinity River Authority (TRA) about availability of, feasibility of, and cost for transporting surface water to a treatment site.

(5) Based on projected direction of growth, develop computer models to recommend alternative locations of regional treatment and storage facilities to the economic benefit of the overall plan. In developing the overall plan, make maximum use of the existing plans and attempt to coordinate the facilities proposed in these plans.

(6) Determine the cost for construction of proposed alternative regional facilities.

(7) Develop phasing of regional transmission, treatment and storage facilities based on projected growth trends.

(8) Put information on computerized Geographic Information System (GIS) compatible with Fort Bend County's ARC/INFO system.

(9) Develop costs for each phase of the project and prorate this cost on a per 1,000 gallon basis. Discuss long term equalization of payments.

(10) Make recommendations concerning the alternatives identified and recommend a technical plan for surface water supply.

Task c. - Water Supply Management Plan

(1) Review alternative methods of management used successfully in other areas and for other utilities and identify alternative management methods for further analysis.

(2) Analyze the alternative management structures with respect to the recommended technical plan for conversion and with respect to the feasibility of implementation of the alternative management structures.

(3) Recommend a management structure based on task c.(1) and c.(2) which appears most feasible for implementation of the technical plan.

(4) Perform an analysis of the legal and institutional changes that may be necessary for implementation of the management structure and prepare a plan for implementation of the management structure.

Task d. - Prepare Water Conservation and Drought Contingency Plan

(1) Prepare a water conservation plan for the planning area to promote the efficient use of water. The plan will be prepared according to the TWDB guidelines. The draft plan shall be provided to the County. Review comments by the TWDB and the County will be incorporated in the projections used in Tasks a. and b. above.

Task e. - Report Preparation

(1) Prepare a report and necessary exhibits which describe the planning study results in detail.

(2) Make recommendations for further study and implementation deemed appropriate.

(3) Present the study results to the project sponsors.

2. Time Schedule by Task

It is anticipated that the planning study will be completed and a draft report submitted by July 15, 1991 and a final report submitted by August 15, 1991. A time schedule by task is presented in Table 1.

3. Budget

The following is a list of the proposed project budget by task and by cost category.

Project Cost by Task	Cost
Evaluation of Subsidence Impact on Flooding	$95,000
Water Supply Technical Plan	110,000
Water Supply Management Plan	60,000
Water Conservation and Drought Contingency Plan	15,000
Report Preparation	20,000
Project Total	$300,000

Project Cost by Category	Fort Bend County	Engineering Subcontractor
Salaries		91,206
Fringe Benefits		31,922
Travel		3,000
Expendable Supplies		3,000
Communication		4,000
Reproduction		6,000
Technical/Computer Activities		5,000
Overhead Costs		119,480
Profit		36,392
Subcontractor Services	$300,000	
Project Cost	$300,000	$300,000

4. Required Project Staff Qualifications and Direct Experience of Potential Subcontractors

A consulting engineering firm or joint venture firms will be selected to do the work in accordance with Fort Bend County's selection procedures. Qualifications required for a consultant to be considered include:

a. past experience in conducting water supply planning studies;
b. experience in engineering planning and design of water treatment plants and distribution systems;
c. knowledge of federal regulatory compliance requirements; and knowledge of the planning area government and citizen concerns;
d. experience in evaluating the effects of subsidence on flooding;
e. experience in fiscal, legal and management aspects of regional water supply systems.

F. Specific Application of the Planning Project to Meeting Identified Problems and Service Needs.

The proposed project approach will address the following concerns:

1. What is the impact and significance of projected subsidence on flooding in Fort Bend County.

2. When and where does Fort Bend County need to convert from groundwater to surface water?

3. Where would the surface water come from to serve Fort Bend County?

4. What would be the cost to convert to surface water?

5. What management approach and institutional procedures should be followed to successfully implement the conversion and equitably distribute the cost of conversion?

V. NOTIFICATION/ASSURANCES

A. Notification

Enclosed in the Appendix is a copy of the certified letter which was sent to known political subdivisions in the County. Also enclosed in the Appendix is a copy of the mailing list for these political subdivisions.

B. Assurances

1. Duplication of existing projects

The proposed planning study will not duplicate existing projects. Several studies in Fort Bend County have been completed which are listed below:

a. Brazos Bend Water Authority Comprehensive Plan - Regional Water Supply and Wastewater Treatment, January 31, 1990.

b. Rosenberg Regional Water Supply Study, March, 1989.

c. Regional Water Supply and Planning Study - Fort Bend County Water Control and Improvement District No. 2 and City of Sugar Land, August, 1988.

These studies addressed conversion to surface water in a limited area and did not address the technical issues regarding the impact of subsidence on flooding. These studies also did not address the potential need for a more regional approach to surface water supply. The proposed study will address, on a comprehensive basis, the potential need for a regional surface water supply system. The proposed study will utilize the data and information contained in these studies to the maximize extent possible to avoid any duplication of effort.

In addition, a study of the impact of subsidence on flooding entitled, A Study of the Relationship between Subsidence and Flooding, December, 1986, was performed. The study did not address specific streams located in Fort Bend County, particularly the Brazos River and Oyster Creek. These two major streams are located in the primary area in Fort Bend County now experiencing significant land subsidence.

2. Implementation

The County, along with other entities, realize the importance of this project and understand that the plan that is developed must be diligently pursued and implemented based on the time tables and schedules developed in the study. The County and other entities will take steps necessary to obtain adequate funding of the solutions as required.

3. Matching Funds

The County, in association with other entities, has the necessary funds available to match the $150,000 requested from the Texas Water Development Board.

4. Water Conservation Plan

As described in the scope of work, a water conservation plan will be developed as part of this project.

TABLE 1
ESTIMATED PROJECT SCHEDULE

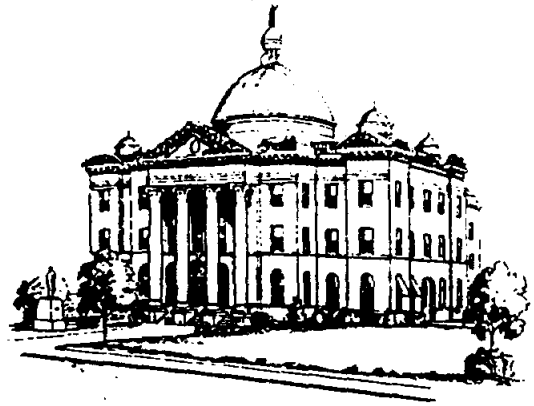
TASK	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
a. Evaluation of Subsidence Impact on Flooding								
b. Water Supply Technical Plan								
c. Water Supply Management Plan								
d. Water Conservation and Drought Contingency Plan								
e. Report Preparation							▲	▼

▲ Submit Draft Report July 15, 1991
▼ Submit Final Report August 15, 1991

APPENDIX

Office of
JODIE E. STAVINOHA
County Judge

P. O. Box 368
Richmond, Texas 77469
(713) 342-3411



STATE OF TEXAS COUNTY OF FORT BEND

November 1, 1990

Re: Regional Water Supply Planning Grant Application

Ladies and Gentlemen:

According to the records of our office, the boundaries of your jurisdiction lay either wholly or partially within Fort Bend County. Fort Bend County is submitting an application to the Texas Water Development Board to obtain a grant to perform a county-wide surface water supply planning study. The proposed study will address the long-term water supply sources and needs of the County over the next 50 years.

Under the procedures drafted by the Texas Water Development Board, we are required to notify you of this grant application. Should you desire to comment regarding this matter we request that you respond in writing to this office and to the Texas Water Development Board no later than thirty days following your receipt of this letter. The address of the Texas Water Development Board is:

Texas Water Development Board
P.O. Box 13231
Capitol Station
Austin, Texas 78711-3231

Attention: Mr. John Miloy

Additional information regarding the grant application may be obtained by contacting Mr. Bill Jameson or Mr. David Winslow at the offices of Lichliter/Jameson & Associates, Inc., at 713/561-5190.

Sincerely,

Jodie E. Stavinoha

Jodie E. Stavinoha
County Judge

JES:sac

Mailing list for political subdivisions in Fort Bend County (Districts and Municipalities).

Districts

Big Oaks MUD
c/o Jo Ann Matthiessen, Attorney
Stubbeman McRae Sealy Laughlin
700 Louisiana, Suite 2400
Houston, Texas 77202

Blue Ridge West MUD
c/o Timothy G. Green, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Burney Road MUD
c/o Joseph M. Schwartz, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Chelford City MUD
c/o Dick Yale, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Cinco MUD 1
c/o Joe Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Cinco MUD 2
c/o James Boone, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Cinco MUD 3
c/o Joe Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Cinco MUD 5
c/o James Murdaugh, Attorney
Smith, Murdaugh, Little & Bonham
1200 Travis, Suite 1800
Houston, Texas 77002

Cinco MUD 6
c/o James Boone, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Cinco MUD 7
c/o Lynne Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Cinco MUD 8
c/o W.D. Yale, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Cinco MUD 9
c/o James Boone, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Cinco MUD 10
c/o Lynne Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Cinco MUD 11
c/o Lynne Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Cinco MUD 12
c/o Lynne Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Cinco MUD 13
c/o Lynne Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Cinco MUD 14
c/o Lynne Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Coastal Plains Soil and Water Conservation District
Attn: Chairman Wilfred Hopmann
980 Frost Street
Rosenberg, TX 77471

Cornerstones MUD
c/o Lynne B. Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Eldridge Road MUD
c/o Franck McCreary, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

First Colony LID 1
c/o Joe Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

First Colony LID 2
c/o Joe Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

First Colony MUD 1
c/o Sue Strawn, Attorney
Stubbeman Mcrae Sealy Laughlin
700 Louisiana, Suite 2400
Houston, Texas 77202

First Colony MUD 2
c/o Joe B. Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

First Colony MUD 3
c/o John Cannon, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001, Fannin, 3300 First City Tower, Suite 800
Houston, Texas 77002

First Colony MUD 4
c/o Joe B. Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

First Colony MUD 5
c/o Joe B. Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

First Colony MUD 6
c/o Sue Strawn, Attorney
Stubbeman Mcrae Sealy Laughlin
700 Louisiana, Suite 2400
Houston, Texas 77202

First Colony MUD 7
c/o Lynne Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

First Colony MUD 8
c/o Lynne Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

First Colony MUD 9
c/o Lynne Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County Drainage District
Attn: Mr. Dan Gerken, Drainage District Manager
P.O. Box 1028
Rosenberg, TX 77471

Fort Bend County LID 2
c/o Joe Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County LID 8
c/o Richard L. Rose, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Fort Bend County LID 11
c/o James A. Boone, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County LID 12
c/o Robert M. Collie, Jr., Attorney
Mayor, Day & Caldwell
1800 NCNB Center, 700 Louisiana
Houston, Texas 77002

Fort Bend County MUD 2
c/o Melinda Butler, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 12
c/o Joe B. Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 13
c/o Terry Yates, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 16
c/o John G. Cannon, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Fort Bend County MUD 19
c/o John R. Wallace, Attorney
Smith, Murdaugh, Little & Bonham
1200 Travis, Suite 1800
Houston, Texas 77002

Fort Bend County MUD 21
c/o Joe B. Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 23
c/o Tim Austin, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 24
c/o Joe Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 25
c/o James A. Boone, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 26
c/o Todd Burr, Attorney
Smith, Murdaugh, Little & Bonham
700 Travis Street, Suite 1800
Houston, Texas 77002-6760

Fort Bend County MUD 27
c/o P. John Kuhl, Jr., Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 28
c/o Sue Strawn, Attorney
Stubbeman McRae Sealy Laughlin
700 Louisiana, Suite 2400
Houston, Texas 77208

Fort Bend County MUD 30
c/o James A. Boone, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 31
c/o James Bonham, Attorney
Smith, Murdaugh, Little & Bonham
1200 Travis Street, Suite 1800
Houston, Texas 77002-6760

Fort Bend County MUD 34
c/o Peter T. Harding, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County MUD 35
c/o Peter Harding, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County MUD 37
c/o Herman I. Little, Jr., Attorney
Smith, Murdaugh, Little & Bonham
1200 Travis Street, Suite 1800
Houston, Texas 77002-6760

Fort Bend County MUD 41
c/o Peter T. Harding, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County MUD 42
c/o James A. Boone, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 44
c/o Ron Young, Attorney
Young, Bacon, Brooks
1415 Louisiana, 5th Floor
Houston, TX 77002

Fort Bend County MUD 46
c/o Timothy G. Green, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Fort Bend County MUD 47
c/o Timothy G. Green, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Fort Bend County MUD 48
c/o Timothy G. Green
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Fort Bend County MUD 49
c/o Charles Patterson, Attorney
Leonard, Marsh, Hurt, Terry
& Blinn
600 Travis, Suite 2000
Houston, Texas 77002

Fort Bend County MUD 50
c/o Lynne B. Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 51
c/o Peter Harding, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County MUD 52
c/o Joseph Schwartz, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County MUD 53
c/o Joseph Schwartz, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County MUD 54
c/o Richard L. Rose, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Fort Bend County MUD 56
c/o John G. Cannon, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Fort Bend County MUD 57
c/o W.D. Yale
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Fort Bend County MUD 58
c/o W.D. Yale
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Fort Bend County MUD 59
c/o Joseph M. Schwartz, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County MUD 65
c/o Dick Yale, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Fort Bend County MUD 67
c/o Timothy G. Green, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Fort Bend County MUD 73
c/o Joe Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 74
c/o Lynne Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Fort Bend County MUD 81
c/o Oliver Pennington, Attorney
Fulbright & Jaworski
1301 McKinney Avenue, Suite 5100
Houston, Texas 77010-3095

Fort Bend County MUD 93
c/o Cheryl B. Krovetz/Robert M. Collie, Attorneys
Mayor, Day & Caldwell
1900 NCNB Center, 700 Louisiana
Houston, Texas 77002

Fort Bend County MUD 94
c/o Joseph M. Schwartz, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County MUD 101
c/o Peter T. Harding, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County MUD 102
c/o Peter T. Harding, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County MUD 103
c/o Peter T. Harding, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County MUD 104
c/o Peter T. Harding
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Fort Bend County Subsidence District
Attn: Ronald Neighbors
P.O. Box 427
Richmond, TX 77469

Fort Bend County WCID 1
c/o Melbert Schwartz
Baker & Botts
3000 One Shell Plaza
Houston, Texas 77002

Fort Bend County WCID 2
c/o Tim Austin, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Grand Mission MUD
c/o Dick Yale, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Harris-Fort Bend MUD 1
c/o Joseph M. Schwartz, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Harris-Fort Bend MUD 3
c/o Pepe Schwartz, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevare, Suite 1400
Houston, Texas 77056

Harris-Fort Bend MUD 4
c/o Peter Harding, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Houston-Galveston Area Council
Attn: Mr. Jack Steele, Executive Director
3555 Timmons Lane
Houston, TX 77027

Kingsbridge MUD
c/o Joe B. Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Meadowcreek MUD
c/o William Philbin, Attorney
Philbin & Associates
7600 W. Tidwell, Suite 204
Houston, Texas 77040

Meadows MUD
c/o Tim Austin, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Memorial MUD
c/o Clifford Youngblood, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Mission Bend MUD 1
c/o Lynne B. Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

North Mission Glen MUD
c/o Dick Yale, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Palmer Plantation MUD 1
c/o Paul A. Philbin, Attorney
Paul A. Philbin & Associates
7600 W. Tidwell, Suite 204
Houston, Texas 77040

Palmer Plantation MUD 2
c/o Paul A. Philbin, Attorney
Paul A. Philbin & Associates
7600 W. Tidwell, Suite 204
Houston, Texas 77040

Pecan Grove MUD 1
c/o Lynne Humphries, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Plantation MUD
c/o Peter Harding, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77027

Post Oak Road MUD
c/o Paul A. Philbin, Attorney
Paul A. Philbin & Associates
7600 W. Tidwell, Suite 204
Houston, Texas 77040

Quail Valley Utility District
c/o Jim Boone, Attorney
Vinson & Elkins
1001 Fannin, First City Tower
Houston, Texas 77002-6760

Renn Road MUD
c/o Jim Boone, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

South Mission Glenn MUD
c/o Dick Yale, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Thunderbird Utility District
c/o Jim Boone, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Via Ranch MUD 1
c/o Joseph M. Schwartz, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Via Ranch MUD 2
c/o Joseph M. Schwartz, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

VIA Ranch MUD 3
c/o Joseph M. Schwartz, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

Via Ranch MUD 4
c/o Joseph M. Schwartz, Attorney
Schwartz, Page & Harding
1300 Post Oak Boulevard, Suite 1400
Houston, Texas 77056

West Keegans Bayou ID
c/o James Boone, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

West Harris Co. MUD 4
c/o W. James Murdaugh, Attorney
Smith, Murdaugh, Little & Bonham
1200 Travis St., Suite 1800
Houston, Texas 77002-6098

Willow Fork Drainage District
c/o Joe B. Allen, Attorney
Vinson & Elkins
1001 Fannin, 3300 First City Tower
Houston, Texas 77002-6760

Willow Point MUD
c/o Dick Yale, Attorney
Coats, Rose, Yale, Holm, Ryman & Lee
1001 Fannin, First City Tower, Suite 800
Houston, Texas 77002

Municipalities

Mayor Mike Saenz
City of Arcola
13222 Highway 6
Arcola, Texas 77583

Mayor Ervin Randermann, Jr.
Town of Beasley
Box 122
Beasley, TX 77417

Mayor John Knox
City of Missouri City
P.O. Box 666
Missouri City TX 77459

Mayor Frances Smart
City of Fulshear
P.O. Box 279
Fulshear, TX 77441

Mayor Kathy Whitmire
City of Houston
P. O. Box 1562
Houston TX 77251

Mayor Ward A. Stanberry
City of Katy
910 Avenue C
P.O. Box 617
Katy, TX 77492-0617

Mayor Ernest Zomalt
City of Kendleton
P.O. Box 700
Kendleton, TX 77451

Mayor Lee M. Duggan,Jr.
City of Sugar Land
P. O. Box 110
Sugar Land. TX 77478 0110

Mayor Jim McDonald
City of The Meadows
11803 Kirkwood
Meadows, TX 77477

Mayor John Stern, D.V.M.
City of Needville
3321 Richmond
P.O. Box 527
Needville, TX 77461

Mayor Eugene L. Demmy
City of Orchard
P.O. Box 59
Orchard, TX 77464

Mayor William J. Poncik
Village of Pleak
5809 Pleak Road
Richmond, TX 77469

Mayor Hilmar G. Moore
City of Richmond
402 Morton
Richmond TX 77469

Mayor Larry Wilkinson
City of Rosenberg
P.O. Box 32
Rosenberg, TX 77471

Mayor Maurice Berkman
City of Simonton
Drawer A
Simonton, TX 77476

Mayor Leonard Scarcella
City of Stafford
2610 South Main
Stafford TX 77477

Mayor G.W. "Bud" Longseere
Town of Thompsons
P.O. Box 24
Thompsons, TX 77481

SEP 10 1991

TWDB Contract No. 91-483-578

STATE OF TEXAS

COUNTY OF TRAVIS

Texas Water Development Board
and
Fort Bend County

WHEREAS, Fort Bend County, Texas, hereinafter termed the County, applied to the Texas Water Development Board, Austin, Texas, hereinafter termed the Board, for a planning grant to develop a regional water supply plan;

WHEREAS, the County has agreed to commit funds to pay for the local share of the planning project;

WHEREAS, the County is the entity who will act as administrator of the Board's planning grant and will be responsible for the execution of this Contract;

WHEREAS, on December 13, 1990, the Board approved the application for financial assistance;

NOW, THEREFORE, the Board and the County, for the mutual consideration stated, agree and understand as follows:

WITNESSETH:

I. PROJECT DESCRIPTION AND SERVICES TO BE PERFORMED BY THE COUNTY

As a joint and cooperative undertaking with the Board, to be financed jointly as hereinafter specified, the County will prepare Phase One of a regional water supply plan for Fort Bend County. The planning area is delineated on Exhibit 1 of Attachment A, the original grant application.

Services and activities provided shall be in strict accordance with requirements of the Texas Water Code, Chapter 15; associated rules of 31 Texas Administrative Code, Chapter 355,

Sections 355.10-355.19; Attachment A, the original grant application, which is made a permanent part of this Contract; and with the following procedures and project descriptions:

1. It shall be the responsibility of the County to establish formal and direct liaison with the entities listed in the Appendix of Attachment A; appropriate officials of the Harris-Galveston Coastal Subsidence District (HGCSD), the Brazos River Authority, the Federal Emergency Management Agency (FEMA), and the U.S. Army Corps of Engineers; and community leaders in the planning area for the purpose of coordinating the work of the planning project and to acquire available data pertinent to the planning effort. Planning shall be coordinated with all related water supply studies, including previous Board funded studies performed for Fort Bend County WCID No. 2, the Brazos Bend Water Authority, the City of Rosenberg, and the West Harris County Surface Water Supply Corporation to provide information for the proposed project, provide a coordinated plan, and avoid duplication of work. As the organizing entity, the County has the responsibility to solicit comments from the general public as to the content of the planning project.
2. The project will produce Phase One of a feasibility-level plan for a regional water supply facility system

for the planning area. The County will conduct Phase One of the planning study according to the following tasks:

I. Evaluate the Impact of Subsidence on Flooding

A. Coordinate with the Fort Bend County Subsidence District (FBCSD) to determine which subsidence cases will be evaluated in the study. Obtain from FBCSD, projections of subsidence at ten-year intervals through the year 2030, based on three alternative assumptions regarding groundwater withdrawals in Fort Bend County and in surrounding counties of Harris, Galveston, Montgomery, and Brazoria.

B. Based on the results of Task I.A., plot the resulting subsidence contours for the alternative cases on appropriate base maps.

C. Identify the areas where significant subsidence is projected and determine which watersheds and stream segments appear to be significantly impacted.

D. For the affected streams, delineate the study limits required and obtain the existing FEMA HEC-2 hydraulic models for each stream. Review these models and update for existing conditions if necessary.

E. Apply the HEC-2 models for updated existing conditions and for the subsidence cases identified in Task I.A. for 100-year flow conditions.

F. Evaluate the results of Task I.E. to determine which areas may be adversely impacted due to increasing flooding levels. Specific areas of concern to be analyzed will include existing development areas and levees. Perform a preliminary economic analysis of the potential damages associated with the increasing flooding.

G. Based on the results of Task I.F., make recommendations concerning the need, timing, and areas requiring conversion to surface water.

II. Develop Water Use Projections and Surface Water Availability Data

A. Compile and review existing studies including the City of Houston Water Master Plan, HGCSD Regional Water Supply Planning Study, and water conversion studies in Fort Bend and west Harris counties.

B. Identify all current sources of municipal or industrial water supply including owners of municipal and industrial water rights, amount

of water under contract, and suppliers of surface water.

C. Consult with Galveston County Water Authority (GCSA), Brazos River Authority (BRA), San Jacinto River Authority (SJRA), and the Trinity River Authority (TRA) about the availability and cost of surface water.

D. Compile and assess population and water use data and projections for the planning area. Use information from other pertinent studies to the degree possible, updating as needed.

E. Prepare population projections by decade from 1990 through 2030. The Board's projections will be considered, and if not selected, an explanation for non-selection will be provided. The Board's projections will be included for comparative purposes in all reports.

F. Develop a water conservation and drought contingency plan for the county to promote the efficient use of water. The plan shall be prepared according to the Board's guidelines. The plan will be provided to the Board for review, and the Board's review recommendations will be incorporated into the plan.

G. Prepare water use projections for each municipal, industrial, and other water-using activity by decade from 1990 through 2030. Incorporate water savings and efficiencies identified by the conservation plan developed in Task II.F. into water demand projections.

III. Prepare Draft and Final Phase One Reports

A. Prepare and submit six copies of a draft Phase One Final Report for Board review.

1. The draft Report will include project methodologies, project results, and recommendations.

2. The draft Report will include an executive summary, which will summarize the Phase One results.

B. Following client and agency reviews and public input, revise draft Phase One Final Report to include comments from the Board, the project advisory committee, and other commentors.

C. Prepare and submit 12 copies of the Final Phase One Report. Clearly indicate by letter to the Board or in the Report how revisions recommended by the Board were addressed and on what pages any recommended changes appear.

3. The project shall include coordinating the water supply plan with existing plans and policies of the County, affected entities, political subdivisions in Fort Bend County, the Texas Water Commission, and the State.

II. PROJECT SCHEDULE AND REPORTS

The County has 90 days, beginning December 13, 1990, to execute this Contract and to provide written evidence acceptable to the Executive Administrator that the County has available its 50-percent matching grant share of $75,000. The Board's approval of a grant to the County will be rescinded on March 13, 1991, if this Contract has not been signed by the County and acceptable evidence of the availability of the County's matching funds has not been provided to the Executive Administrator.

The term of this Contract shall begin and the County shall begin performing its obligations hereunder on December 13, 1990. The County shall complete the work program stated in Article I, above, no later than July 15, 1991, unless such date is extended as provided below, at which time the County shall deliver six (6) copies of a draft Phase One Final Report.

After a 20-day review period, the draft Final Phase One Report together with review comments will be returned to the County. A Phase One Final Report incorporating any required changes must be submitted to the Board by August 31, 1991. Deadlines may be extended only in writing by the Board. Twelve (12) copies of the Final Phase One Report shall be delivered to

the Board. Delivery of an acceptable Final Report prior to August 31, 1991, shall constitute completion of the terms of the Contract.

Monthly progress work reports which summarize the work completed through the period of the submitted State of Texas Purchase Voucher will be submitted by the County to the Board by the 20th of the month following the period covered by the Voucher. The work report will contain the following information:

1. Task names and descriptions.
2. Total cost of the individual tasks, including TWDB and County portions.
3. Percent of the tasks completed.
4. Dollar value of the percent of the tasks completed.
5. Total tasks completed, indicating the percent of and dollar value of the project completed as reflected in totals of all State Vouchers submitted.

Coordination meetings will be held in April and July 1991 and when deemed necessary to discuss the status of the study. Representatives of affected entities in the planning area and the Texas Water Development Board will be invited to the meetings.

The County will schedule the April coordination meeting so that a narrative status report on the project can be written by the County and submitted to the Board within 10 working days after the coordination meeting. An interim status report will not be required after the draft Final Report has been submitted

for review. The status report shall be in letter form and shall contain the following information:

1. A brief statement of the overall progress made since the beginning of the study.
2. A brief description of any problems that have been encountered during the reporting period that will affect the study, delay the timely completion of any portion of the Contract, or will inhibit the completion of or cause a change in any of the project products or objectives.
3. A description of actions the County or the contractors plan to take to correct any problems described in item 2 above or change any schedule, product, or objectives stated in the Contract.

If for any reason the County is unable to complete the work program called for under the terms of this Contract on or before July 15, 1991, and is unable to deliver the Final Report on or before August 31, 1991, the County and the Board hereby agree to consider negotiating an extension of the Contract period; however, the Board will not be liable for more than $75,000 for the entire Contract. The Board must, however, be notified in writing ten (10) working days prior to the date for completion of the work program or thirty (30) days prior to the date for submittal of the Final Phase One Report that the County will be requesting renegotiation.

III. COMPENSATION AND REIMBURSEMENT

The Board, for and in consideration of the obligations and responsibilities undertaken by the County, hereby agrees to compensate and reimburse the County, in a total amount not to exceed $75,000, upon the submission of invoices and State Purchase Vouchers representing costs incurred by the County pursuant to performance of this Contract. The County will also submit evidence that charges to subcontractors have been paid. The County will contribute $75,000, representing fifty (50) percent of the total project cost, in the form of cash.

A. Reimbursement to the County shall be made in accordance with the following budget, with the Board contributing $75,000, or 50 percent, of the total project cost, in the form of cash.

EXPENSE BUDGET
Regional Water Supply Planning
Study for Fort Bend County

	Category	Total Budget	Engineering
A.	Salaries & Wages*	$ -0-	$ 45,603
B.	Fringe*	-0-	15,961
C.	Travel	-0-	1,500
D.	Expendable Supplies	-0-	1,500
E.	Subcontract Services	150,000	-0-
F.	Technical/Computer Services	-0-	2,500
G.	Communications	-0-	2,000
H.	Reproduction	-0-	3,000
I.	Overhead*	-0-	59,740
J.	Profit	-0-	18,196
	TOTAL	$150,000	$150,000

TASK BUDGET
Regional Water Supply Planning
Study for Fort Bend County

Task No.	Description	Amount
I.	Evaluate the Impact of Subsidence	$ 95,000
II.	Develop Water Use Projections and Surface Water Availability Data	47,000
III.	Prepare Draft and Final Phase One Reports	8,000
	Total Task Budget	$150,000

* Definition of Contract Budget Terms

1. Salary Cost is defined as the cost of salaries of engineers, draftsmen, stenographers, surveymen, clerks, laborers, etc., for time directly chargeable to the project.
2. Fringe Costs are defined to include social security contributions, unemployment excise and payroll taxes, employment compensation insurance, retirement benefits, medical and insurance benefits, sick leave, vacation, and holiday pay applicable thereto.
3. Overhead Costs are those costs incurred by the prime contractor and subcontractors in maintaining a place of business and performing professional services similar to those specified in this contract project description. These expenses shall include the following:
   - o Indirect salaries, including that portion of the salary of principals and executives that is allocable to general supervision
   - o Indirect salary fringe benefits
   - o Accounting and legal services related to normal management and business operations
   - o Travel costs incurred in the normal course of overall administration of the business
   - o Equipment rental
   - o Depreciation of furniture, fixtures, equipment, and vehicles
   - o Dues, subscriptions, and fees associated with trade, business, technical, and professional organizations
   - o Other insurance
   - o Rent and utilities
   - o Repairs and maintenance of furniture, fixtures and equipment

The County shall submit monthly bills to the Board for payment. The monthly reimbursement billing will include monthly invoices, State Purchase Vouchers supplied by the Board, and evidence of the County's payment of subcontract charges for work

performed. Said invoices and vouchers shall be supported by sufficient detail to substantiate billings by the County, said detail to include the following:

(1) For direct expenses incurred by the County for outside consulting services--copies of invoices to the County showing the tasks that were performed; the percent and cost of each task completed; a total costs figure for each direct expense category including labor, fringe, overhead, travel, communication and postage, technical and computer services, expendable supplies, printing and reproduction; and the total dollar amount due to the consultant. Copies of invoices and receipts for direct expenses shall accompany the monthly State Purchase Voucher.

(2) For travel and subsistence expenses, including such expenses for subcontractors--names, date, work location, time period at work location, itemization of subsistence expenses of each employee, limited, however, to travel expense authorized for state employees by General Appropriation Act, Tex. Laws 1989, Ch. 1263, Art. V, Sections 14 and 15, at 5771 or as amended;

(3) Other transportation costs--copies of invoices covering tickets for transportation or, if not available, names, dates, and points of travel of individuals; and

(4) All other reimbursable expenses--invoices or purchase vouchers showing reason for expense with receipts to evidence the amount incurred.

The County is fully responsible for paying all charges by subcontractors prior to submitting a bill to the Board. The Board will, in turn, reimburse the County for the Board's share of the payment, minus the retained amount. Acceptable evidence of County payment must accompany the County's request for Board reimbursement. A copy of the County's check to the subcontractors shall constitute acceptable evidence of payment.

B. The Board shall reimburse the County only upon receipt of an invoice, satisfactory documentation of expenses, a State Purchase Voucher, and evidence of County payment of subcontractor charges; provided, however, the Board shall only pay up to ninety (90%) percent of the Board's share of each invoice pending the County's performance, completion of the Final Report, and acceptance and approval of said report by the Board. At the time of said performance, completion, and approval of the report by the Board, the Board shall pay the remaining ten (10%) percent to the County. The County and its subcontractors may withhold retainage on the County's share of the monthly cash billing, but retainage may not be withheld by the County or its subcontractor's on the Board's share of the monthly billing.

C. The County and the subcontractors shall maintain satisfactory financial accounting documents and records and shall make them available for examination and audit by the Board.

Accounting by the County and the subcontractors shall be in a manner consistent with generally accepted accounting principles.

IV. PUBLICATION AND SUBCONTRACTING

The Board shall have unlimited rights to technical or other data resulting directly from the performance of services to the Board under this Contract.

It is agreed that the water supply planning materials developed by the County pursuant to this Contract shall become the joint property of the County and the Board in which the Board retains the right to establish copyrights. The County may not establish copyrights for the planning materials developed pursuant to this Contract unless the County requests and the Board assigns to the authority in writing the right to establish a copyright; provided, however, that copyrighting by the County will in no way limit the Board's access to or right to request and receive data and information obtained or developed pursuant to this Contract. Any water supply planning materials subject to a Board copyright and produced by the County or Board pursuant to this Contract may be printed by the County or Board at their own cost and distributed by either at their discretion within the State of Texas. The County may otherwise utilize such material provided under this Contract as it deems necessary and appropriate, including the right to publish and distribute the materials or any parts thereof under its own name within the

State of Texas, provided that any Board copyright is appropriately noted on the printed materials.

The County agrees to acknowledge the Board in any news releases or other publications relating to the work performed under this Contract.

No work herein called for by the County shall be subcontracted or assigned without prior written approval of the Executive Administrator of the Board for such subcontract. The subcontract shall include a detailed budget estimate with specific cost details for each item of the work to be performed by the subcontractor and for each category of reimbursable expenses. The subcontracts shall conform to the terms of the Contract and include provisions which require subcontractor compliance with Board rules. The County must also adhere to all requirements in state law pertaining to the procurement of professional services.

V. AMENDMENT, TERMINATION, AND STOP ORDERS

The Board's approval of a $75,000 grant to the County will be rescinded on March 13, 1991, if this Contract has not been signed by the County and acceptable evidence of the availability of the County's matching funds has not been provided to the Executive Administrator.

This Contract may be altered or amended only by mutual written consent and may be terminated by the Board at any time by written notice to the County. Upon receipt of such notice, the

County shall, unless the notice directs otherwise, immediately discontinue all work in connection with the performance of this Contract and shall proceed to cancel promptly all existing orders insofar as such orders are chargeable to this Contract. The County shall submit a statement showing in detail the work performed under this Contract to the date of termination. The Board shall then pay the County promptly that proportion of the prescribed fee which applied to the work actually performed under this Contract, less all payments that have been previously made. Thereupon, copies of all completed work accomplished under this Contract shall be delivered to the Board.

The Board may issue a Stop Work Order to the County at any time. Upon receipt of such order, the County is to discontinue all work under this Contract and cancel all orders pursuant to the Contract, unless the order directs otherwise. If the Board does not issue a Restart Order within 60 days after receipt by the County of the Stop Work Order, the County shall regard this Contract terminated in accordance with the foregoing provisions.

VI. NO DEBT AGAINST THE STATE

This Contract and Agreement shall not be construed as creating any debt by or on behalf of the State of Texas and the Texas Water Development Board, and all obligations of the State of Texas are subject to the availability of funds.

VII. LICENSES, PERMITS, AND INSURANCE

For the purpose of this Contract, the County will be considered an independent contractor and therefore solely responsible for liability resulting from negligent acts or omissions. The County shall obtain all necessary insurance, in the judgment of the County, to protect themselves, the Board, and employees and officials of the Board from liability arising out of the Contract. The County shall indemnify and hold the Board and the State of Texas harmless, to the extent that the County may do so in accordance with State Law, from any and all losses, damages, liability, or claims therefore, on account of personal injury, death, or property damage of any nature whatsoever caused by the County, arising out of the activities under this Contract.

The County shall be solely and entirely responsible for procuring all appropriate licenses and permits which may be required by any competent authority for the County to perform the subject work.

VIII. SEVERANCE PROVISION

Should any one or more provisions of this Contract be held to be null, void, voidable, or for any reason whatsoever, of no force and effect, such provision(s) shall be construed as severable from the remainder of this Contract and shall not affect the validity of all other provisions of this Contract which shall remain of full force and effect.

IX. CORRESPONDENCE

All correspondence between the parties shall be made to the following addresses:

For the Board:
Texas Water Development Board
P. O. Box 13231, Capitol Station
Austin, Texas 78711-3231
Attn: G. E. Kretzschmar
Executive Administrator

For the County:
County of Fort Bend
P. O. Box 368
Richmond, Texas 77469
Attn: The Honorable Roy Cordes
Judge of Fort Bend County

IN WITNESS WHEREOF the parties hereto cause this Contract and Agreement to be duly executed in triplicate.

TEXAS WATER DEVELOPMENT BOARD

By: _____
G. E. Kretzschmar
Executive Administrator

Date: Jan. 31, 1991

COUNTY OF FORT BEND

By: _____
The Honorable Roy Cordes
County Judge

Date: 1/30/91

ATTACHMENT A

APPLICATION

TO

TEXAS WATER DEVELOPMENT BOARD
AUSTIN, TEXAS

FOR

REGIONAL WATER SUPPLY
PLANNING GRANT

FOR

FORT BEND COUNTY

BY

FORT BEND COUNTY

APPENDIX B
WATER CONSERVATION PLAN &
EMERGENCY WATER DEMAND CONTINGENCY PLAN

1.0 INTRODUCTION

Fort Bend County is a political subdivision of the State of Texas located southwest of the City of Houston. The County encompasses approximately 876 square miles and includes the cities of Arcola, Fulshear, Kendleton, Meadows, Missouri City, Needville, Orchard, Pleak, Richmond, Rosenberg, Simonton, Stafford and Sugar Land. Also included are the towns of Beasley and Thompsons, numerous municipal utility districts, and portions of the cities of Houston and Katy.

Population in Fort Bend County increased 72 percent between 1980 and 1990, from 130,846 to 225,421, the largest growth area in Texas. By the year 2030 the population is projected to increase by between 170 and 200 percent.

The 1990 municipal water demand recorded by FBSD was 38.2 million gallons per day (mgd), most of which was supplied by groundwater pumping from the underlying Chicot and Evangeline aquifers. These aquifers also supply most irrigation, agricultural and industrial water demands in Fort Bend County. The total water demand for the county has been estimated to have been 123 mgd in 1990. Surface water currently supplies approximately 46 percent of the total water demands in Fort Bend County, or 56.2 mgd.

Concerns with the effects of the overall rate of groundwater withdrawal led to the creation of the Fort Bend Surface Water Supply Corporation (FBSWSC) to develop and administer a county wide water supply plan. The FBSWSC study is currently analyzing the technical feasibility of implementing a coordinated plan for water production by Fort Bend County as a means of better managing the available water resources, as well as addressing the legal and economic considerations associated with using a single entity to organize and manage the water resources. In this regard, the FBSWSC obtained financial assistance from the Texas Water Development Board (TWDB) in the amount of $75,000. One of the requirements of the contract regulating the TWDB planning grant is the need to develop a Water Conservation Plan and Emergency Water Demand Contingency Plan as part of the overall regional water supply plan.

Although related, a Water Conservation Plan is distinct from an Emergency Water Demand Management Plan in that a Water Conservation Plan describes the means and methods of attaining an overall reduction in water demand. This may result from reduced water consumption, enhanced efficiency in the use of

water, or increased recycling and reuse of water. An Emergency Demand Management Plan, sometimes called a Drought Contingency Plan, includes measures to be implemented during emergency conditions to cause a significant, but temporary, reduction in water use; this is usually accomplished through the use of alternative sources of water as well as reductions in water use.

2.0 UTILITY EVALUATION DATA

Neither Fort Bend County nor the FBSWSC currently provides water to users. Many cities and municipal utility districts (MUD) within the county operate independent water supply systems to serve their citizens. Frequently, one water supply system will serve two or more MUD's. Persons living in rural areas are often served by independently owned wells. Groundwater pumping supplies the majority of the municipal water demands, as well as other water-related demands such as agricultural, commercial and industrial. In October, 1991, there were 545 permitted water wells in Fort Bend County. Of these, 174 serve as public water supply, 79 are used for industrial purposes, and the remaining 292 are used for irrigation.

Surface water is currently used to serve a large portion of agricultural and industrial demands within the county. The following is current data regarding water usage in Fort Bend County. Certain information is not available or not applicable due to the limited scope of the duties of the FBSWSC.

Water Supply and Distribution System Information
for the Regional Water Supply Plan for Fort Bend County

•	Population of Service Area (1990 Census)	225,421
•	Size of Service Area	876 sq. mi.
•	Water Supply Information	
	• Water Supplied during the Last Year	N/A
	• Average Water Supplied for Last 3 Years	N/A
	• Estimated Monthly Water Sales for the Last Year	N/A
	• Highest Daily Water Use on Record for System	N/A
	• Peak Daily Use for the Last Year	N/A
	• Unaccounted for Water	
	• Unaccounted for Water (Production - Sales) / Production x 100 =	N/A
•	Number and Type of Meter Connections in Service Area	N/A
•	Net Gain (Loss) of New Connections Per Year	N/A

Source of Water	Volume of Water (MGD)
Groundwater	63.0
Surfacewater	53.7

•	Safe Annual Yield of Water Supply	N/A
•	Design Capacity of Water System (Public Water Supply)	1104 mgd
•	Major High-Volume Consumers (1990)	

Name

HL & P

Imperial Holly Corporation

Nalco Chemical Company

DOW Chemical, U.S.A.

Gulf Coast Water Authority

- Population and Water Use Projections

Year	1990	2000	2010	2030
Population	225,421	357,100	475,123	680,804
Water Demand (MGD)				
Municipal (MGD)	37.0	58.6	78.0	111.7
Industrial (MGD)	9.7	15.5	21.2	32.7
Irrigation (MGD)	13.6	13.9	14.2	14.7
Power (MGD)	27.2	27.8	28.3	29.4
Agricultural (MGD)	19.5	19.5	19.5	19.5
TOTALS (MGD)	107.0	135.3	161.2	208.0

Wastewater System Information

- Service Area Information

  Percent of Your Potable Water Customers Sewered by the Utility's Wastewater Treatment System N/A

  Percent of Your Potable Water Customers Who Have Septic Tanks or Other Privately Operated Sewage Disposal Systems N/A

  Percent of Your Potable Water Customers Sewered by Another Wastewater Treatment Utility N/A

- Wastewater System Capacity Information

  Average Daily Volume of Wastewater Treated for the Most Recent Year N/A

  Peak Daily Wastewater Volumes During the Last Year

Wastewater Treatment System Permitted Capacity:

Average Daily Capacity	N/A
Maximum Daily Capacity	N/A

- Estimated Percent of wastewater flows to your treatment plant that originate from the following categories:

Residential	N/A
Industrial/Manufacturing	N/A
Commercial/Institutional	N/A
Storm Water	N/A
Other	N/A

Utility Financial Operations Information

- Water or Rate Structure N/A
- Sources of Revenue for the Utility N/A

Percent of Annual Revenues from Water or Wastewater Rates N/A

Percent of Annual Revenues from All Other Sources N/A

- Annual Operating Costs N/A

Average Annual Operating Costs N/A

Percent of Average Annual Operating Costs that are Fixed Costs N/A

Percent of Average Annual Operating Costs that are Variable Costs N/A

3.0 NEED FOR AND GOALS OF THE PROGRAM

The overall rate of groundwater withdrawal in the Fort Bend County area has resulted in the lowering of potentiometric levels and the compaction of underlying clay layers within the aquifers. Declining water levels and land subsidence have contributed to ground faulting, deterioration in groundwater quality, and increased water production costs in other portions of the Houston, Texas area and have the potential for causing similar problems in Fort Bend County. The Phase I report discusses these potential problems in detail in Section VI.

The Addicks, Clodine and Penn fault systems in Fort Bend County are located where population concentration is high and land is developing rapidly. Major structural damage was associated with the Addicks fault as it became more active throughout subdivisions in Harris County. Increased groundwater pumpage has been linked to an increase in fault activity in neighboring counties.

The groundwater in Fort Bend County is of relatively high quality and requires only disinfection before being distributed to consumers. In December, 1991, no systems from Fort Bend County were on the Texas Department of Health (TDH) maximum containment level (MCL) violation list. Although no problems with groundwater currently exist, possible complications may arise due to the continuing drop in water table elevation.

Eight salt domes existing in Fort Bend County pierce the Chicot and/or Evangeline aquifers. Groundwater adjacent to salt domes typically will have a higher saline content. Depending on a well's pumping rate and potentiometric surface, it is possible for the groundwater around the salt dome to exhibit deterioration in its groundwater quality over time. Intermediate sands in the Chicot aquifer contain water with more than 1000 mg/l total dissolved solids (TDS) in areas around six of the eight salt domes.

If future water demand due to population growth in the greater Houston area were to depend solely on groundwater, it is projected that the potentiometric level in the aquifers in Fort Bend County will decline between 11 and 151 feet depending upon the location in the county. This decline in potentiometric surface will require more horsepower to lift the water and, in many cases, may require the wells to be replaced. The future workover costs and new well costs to maintain existing groundwater capacity for all permitted wells in Fort Bend County are estimated to be $37 million by the year 2030. The majority of this cost, $3 million, is attributable to new wells.

The goal of the County's Water Conservation Plan is to achieve a permanent reduction in water demand through efficient water use and reuse practices. The goal of the County's Emergency Water Demand

Management Plan is to promote various conservation measures, as well as to establish a mechanism for prohibiting certain other uses during a shortage emergency. Since the FBWSC does not have the authority to enact water conservation measures, implementation of a water conservation program will have to be on a voluntary basis.

4.0 LONG-TERM WATER CONSERVATION PLAN

Elements of a water conservation program should include:

- Education and information programs;
- Plumbing code standards for water conservation in new construction;
- Retrofit programs to enhance water conservation in existing buildings;
- Water rate structures including conservation incentives;
- Universal metering and meter repair and replacement;
- Leak detection and repair;
- Water recycling and reuse;
- Pressure reduction;
- Water-conserving landscaping;
- Emergency water demand management plans; and
- Ordinances and emergency procedures.

Education and Information Programs

The most readily available and lowest cost method to promote water conservation is to inform water users of ways to save water in the home and in other buildings, in landscaping and lawn care, and in recreational uses. In individual single-family homes, it is common for more than half of the water used in the summer to be used for exterior residential purposes such as lawn watering and car washing. Average residential water use is forty percent for toilet flushing, thirty five percent for bathing, eleven percent for kitchen uses, and fourteen percent for laundry.

The Fort Bend Subsidence District (FBSD), along with the Harris-Galveston Coastal Subsidence District (HGSD) believe that the most effective effort toward encouraging water conservation is through raising public awareness of water as a precious resource. Once there is an understanding of the vital role of water in our lives, individuals can make a commitment to eliminate wasteful water uses. It is estimated that simply reducing waste can result in a 10 percent decrease in water use in an average home.

The Subsidence Districts biannual newsletter provides valuable information on water conservation.

In addition, the Subsidence Districts have implemented a program designed to educate elementary and middle school students in water conservation. All Texas public school students are required, by law, to protect all hardback, state-issued textbooks with a book cover. Public school districts are required by the Texas Education Agency to provide textbook covers to students free of charge. The Subsidence Districts have purchased book covers for approximately 465,000 students. The book covers contain educational

material covering water conservation. At least one book cover will be provided to each student, aged 6 to 14 years, each semester of the school year. This program will thus reach two audiences. First, the youth who are just establishing thinking patterns that will last a lifetime. And second, the adults of the family.

In disseminating information regarding water-saving practices, a combination of the following methods should be used:

- Television, radio, and newspaper announcements and advertisements;
- Posters and public displays;
- Fairs, contests, and school programs;
- Brochures, pamphlets, and newsletters;
- Speakers programs; and
- Promotional events.

Plumbing Codes

Action taken by the 72nd Texas Legislature requires that plumbing fixtures sold in Texas after January 1, 1992, must meet the following standards:

FIXTURE	STANDARD
Shower Heads	Less than 2.75 gallons per minute at 80 psi pressure
Lavatory & Sink Faucets & Aerators	Less than 2.2 gallons per minute at 60 psi pressure
Wall-Mounted, Flushometer Toilets	Less than 2.0 gallons per flush
All Other Toilets	Less than 1.6 gallons per flush
Urinals	Less than 1.0 gallons per flush
Drinking Water Faucets	Must be self-closing

In addition to these legislated criteria, cities and counties should adopt ordinances that require:

- Insulation of hot water pipes;
- Installation of pressure-reduction valves where system pressures exceed 80 psi;
- New swimming pools utilize recirculating filtration equipment;

- Faucets in public restrooms have either self-closing or metering valves with maximum flow rates not to exceed 0.5 gallons per minute at 60 psi.
- Limit the use of evaporative coolers or require the use of recirculating evaporative coolers;
- Require that all decorative fountains recirculate water.

A city or utility should also encourage retrofitting plumbing fixtures, lawn watering equipment, or water-using appliances; these include low-flow shower heads, toilet dams, and faucet aerators. Information regarding these devices should be disseminated through the public education program.

Water Rate Structures

Rate structures used to promote water conservation generally encourage reduced water demand, particularly during periods of peak demand in the summer season. Rather than discouraging high levels of water usage, the traditional declining block rate structure provides declining unit costs of water as usage increases. Uniform rates do not provide the same incentive to use greater amounts of water as declining block rates do, but they also do not provide incentives to water use. The increasing (or inverted) block rate structure, which includes higher water costs per unit at higher levels of water usage, encourages water conservation, as does a rate structure providing for higher water costs during the peak summer season.

Metering

All water users should be metered separately in order to accurately measure water usage. New construction in multi-family residential units should require an individual meter per unit.

A regular repair and replacement program should be established for water meters. The scheduling should be determined by the type of meter, water quality, and the average volume passing through the meter. In accordance with Texas Water Development Board recommendations, the following frequency schedule should govern meter inspection:

Type of Meter	Testing Interval
Production (master)	Annually
Meters larger than 1½"	Annually
Meters 1½" or smaller	Every ten years

Water utilities should also periodically cross-check a user's water usage against that of previous months in order to identify connections where water use has increased dramatically or where the meter may have slowed down or is operating improperly. Meter readers should also be trained to identify unusual situations where meters may be operating improperly.

Unmetered water uses, such as that used for fire fighting or flushing water distribution or sewer lines, should be estimated wherever possible. A water audit system should be established to calculate the quantity of unaccounted-for water on a regular, at least annual, basis. Utility companies may be able to identify and bill previously unbilled water users and thereby generate additional revenue.

Leak Detection and Repair

A continuous leak detection, location, and repair program, coordinated with an annual water audit, should be an important part of a water conservation plan. Elements to be considered in this plan include:

- Defective hydrants
- Abandoned services
- Inaccurate or leaking meters
- Illegal hook-ups
- Unauthorized use of fire hydrants
- Leaks in main or services

Water Recycling and Reuse

A city or utility should evaluate the potential of using recycled or reused water in the service area. Whenever feasible, given quality and health concerns, the use of wastewater in place of fresh water should be encouraged. Using wastewater, such as treated industrial or municipal effluent, or agricultural return flows, in place of fresh water can be an important water supply expansion tool, particularly for landscape and golf course watering.

Pressure Reduction

Pressure in customer service lines should be reduced so that they not exceed 80 psi. It is not known at this time if excessive pressure exists in parts of the distribution systems.

Water-Conserving Landscaping

Since as much as fifty percent of peak demand is generated by landscaping, cities and utilities should:

- Establish regulations for new subdivisions that require developers, landscape architects, contractors, and homeowners to use only appropriate low water-using plants and grasses and efficient irrigation systems for landscaping new homes and facilities;
- Initiate and publicize a xeriscape program that demonstrates the use of adapted low water-using plants and grasses;
- Require landscape contractors to use drip irrigation systems wherever possible, and to design all irrigation systems with water conservation features, such as sprinklers that emit large drops rather than a fine mist, soil moisture monitoring, rain shut-off controls, and a sprinkler layout that accommodates prevailing wind direction;
- Establish water usage guidelines for car washes, commercial laundries, and other commercial and industrial establishments
- Provide economic incentives for commercial and industrial establishments to reduce water use

Implementation

At present, the Fort Bend Surface Water Supply Corporation does not own or operate any water systems. However, the Corporation can strongly encourage each entity in Fort Bend County to develop a program. If the Corporation does acquire systems, loans money to finance system improvements, or creates subdistricts, water conservation programs can be mandated. While cities can mandate required water conservation, the power of private water companies is limited to education and providing information about water conservation techniques, setting water conservation-oriented rates, and implementing an effective leak detection program. Phase 2 of the Fort Bend County Surface Water Supply Study will address the economic and technical feasibility of regional surface water supply in Fort Bend County and will also evaluate various alternative corporate/municipal entities to administer the plan.

5.0 EMERGENCY WATER DEMAND MANAGEMENT PLAN

Drought or other unforeseen emergencies, such as water contamination, may disrupt water supplies on a temporary basis. Consumer demand during water shortage conditions may be even higher than normal, and older systems already operating at capacity levels may not be able to meet this demand without system failure. Treatment, storage, or distribution measures may also be used by water suppliers during emergency demand management situations.

Trigger Conditions

The city, utility or other water supplier should establish a set of trigger or threshold conditions which would indicate that emergency water demand management practices need to be put into effect. Three trigger levels should be established, labelling the situation as mild, moderate, or severe. Conditions for a downgrading of the emergency also should be established, as do provisions to declare emergency water demand management practices to be in effect when such events as multiple component failures or water supply contamination have occurred.

Mild Conditions

- Water demand has reached or exceeded a specified percentage of the safe capacity of the system.
- Lake, stream flow or well levels are still high enough to provide an adequate supply, but the levels are low enough to disrupt some other beneficial activity.
- The water supply is still adequate, but the water levels or reservoir capacities are low enough that there is a possibility that the supply situation may become critical if the drought or emergency continues.

Moderate Conditions

- Water demand has reached the predetermined limit of the system, beyond which the failure of a pump or some other piece of equipment could cause a serious disruption of service to part or all of the system.
- Reservoir levels, well levels, or river flows have reached the second impact level beyond which operational problems will occur.
- Water supply storage levels have declined to the second impact level.

Severe Conditions

- The imminent or actual failure of a major component of the system has occurred which will cause an immediate health or safety hazard.
- Water demand has reached or is exceeding the third impact level. For instance, if demand exceeds the system's capacity on a regular basis, it would present the imminent danger of a major system failure.
- Lake or river, or well levels have declined to the third impact level. For instance, lake levels are so low that diversion or pumping equipment will not function properly.
- Water levels are low enough in the distribution system storage reservoirs to hinder adequate fire protection.

Emergency Water Demand Management Measures

The city or utility should establish emergency measures and a plan for implementation when predetermined trigger conditions are met. Specific measures include:

- Imposing restrictions or bans on nonessential uses such as lawn watering, car washing, and pool filling;
- Communicating methods to reduce the quantity of water needed for the essential purposes of drinking, cooking, bathing, and laundry;
- Implementing rationing plans;
- Establishing pricing structures that incorporate surcharges and penalties or fines for noncompliance;
- Locating, assessing, and securing additional sources, including wells, ponds, reservoirs, reactivated wells or dams, purchasing water from others on an emergency basis, building emergency facilities, and temporary reuse of wastewater for nonpotable uses; and
- Designing means of enforcement.

Mild Conditions

- Inform the public by mail and through the news media that a trigger condition has been reached, and that water users should look for ways to reduce water use.
- Activate an information center and discuss the situation in the news media.
- Advise the public of the trigger condition situation daily.
- Advertise a voluntary daily lawn watering schedule.

Moderate Conditions

- Implement a mandatory lawn watering schedule.
- Assess fines to water wasters.
- Institute an excessive use fee, special pricing structure, or surcharge.
- Prohibit certain uses such as ornamental water fountains, hydrant flushing, street cleaning, or other nonessential water uses.
- Request industries or other nonmunicipal water users to stop certain uses, find alternative sources, increase recycling, or modify production processes where possible.

Severe Conditions

- Prohibit all outdoor water use.
- Limit the amount of water each customer can use and take legal action as needed to secure compliance.
- Require industrial or commercial water users to stop operations so that remaining water is available for essential health and safety related uses.

Information and Education

The public should be informed of what will be expected during a drought or emergency water situation. Therefore, once an emergency water demand management plan has been adopted, the public should be informed about its content and the purpose of the plan prior to the onset of emergency conditions. The informational material should describe the trigger conditions and the emergency measures to be implemented in the event of an emergency. Methods of educating the public include:

- Public meetings;
- Radio and television public service announcements and news stories;
- Newspaper articles and advertisements; and
- Letters, bill inserts or messages, and brochures to water customers.

Initiation and Termination Procedures

The city or utility should have written procedures that contain adequate methods of informing customers, other utilities, and government entities as far in advance as possible that a trigger condition is being approached or that it has been reached, and that a certain phase of the emergency water demand management plan must be implemented. These written procedures should include:

- Automatic regulatory implementation provisions;
- Prearranged media notification or press release procedures;
- Direct notification procedures including mail or, if needed, telephone notification procedures;
- Prearranged contract procedures to obtain emergency water supplies from other sources if needed; and
- Checklists or operating procedures as necessary.

Written termination procedures should be established to inform customers and other directly affected parties that the emergency conditions have passed.

Implementation

The primary reason for developing a plan is to have a guide for implementing an emergency water demand management program if the need occurs. It should be the intent of the water supplier to develop a workable plan that customers understand and which can be implemented in the event that it is needed. In order to accomplish this, each city or utility should to develop and adopt legal and regulatory documents or instruments that are appropriate.

Legal and regulatory components that may be necessary for implementation include:

- Ordinances, bylaws, or other implementing legal documents;
- Changes in plumbing codes;
- New or revised contracts with potential water suppliers;
- Contract conditions with industries or commercial water users whose water supplies may be curtailed during emergency conditions; and
- Changes or conditions to water rights permits or contracts with current water suppliers.

Fort Bend County

Surface Water Supply Study

Phase 2

FORT BEND COUNTY SURFACE WATER SUPPLY STUDY - PHASE 2

TABLES

LIST OF EXHIBITS

FORT BEND COUNTY SURFACE WATER SUPPLY STUDY - PHASE 2

SECTION I - INTRODUCTION

This report is the second in a two-part series examining water supply issues in Fort Bend County. The Phase 1 study compiled existing data on water supply systems in Fort Bend County to summarize projections of future water use and to determine the impacts of flooding caused by subsidence related to groundwater withdrawal. The Phase 1 study established population growth estimates, the predicted increase in water demand represented by this growth, and the estimated savings that can be realized through water conservation. This information, along with the information presented in four separate reports concerning conversion to surface water for individual segments of the county, is the basis for this Phase 2 report to develop a plan for management of all water resources -- whether groundwater, surface water, or a combination of the two -- for public consumption.

OBJECTIVES AND TASKS

Objectives of this study are:

- to assess the impacts of continued reliance on groundwater as a potable water supply source
- to examine alternative technical plans for water supply
- to evaluate the feasibility of regional water supply management

The overall scope of work for this study includes evaluating the impact of subsidence on flooding and developing a water supply technical plan. Development of a regional water supply management plan to address the political, financial, and legal aspects of such a regional plan also is included in the scope of work. In addition, a water conservation and drought contingency plan is to be developed for Fort Bend County.

Four previous studies, conducted on behalf of the Brazos Bend Water Authority, the West Harris County Water Supply Corporation, Richmond/Rosenberg, and Sugarland/Fort Bend County Water Control and Improvement District #2, all were based on the assumption that conversion from groundwater to surface water was a near-term goal that must be planned and implemented in a short period of time. Since the information developed in the Phase 1 Study does not demonstrate a need for immediate conversion to surface water, the underlying premise of Phase 2 was to develop a plan to manage and conserve all water resources to provide the greatest benefit to the growing populations in Fort Bend County in the most economical manner possible.

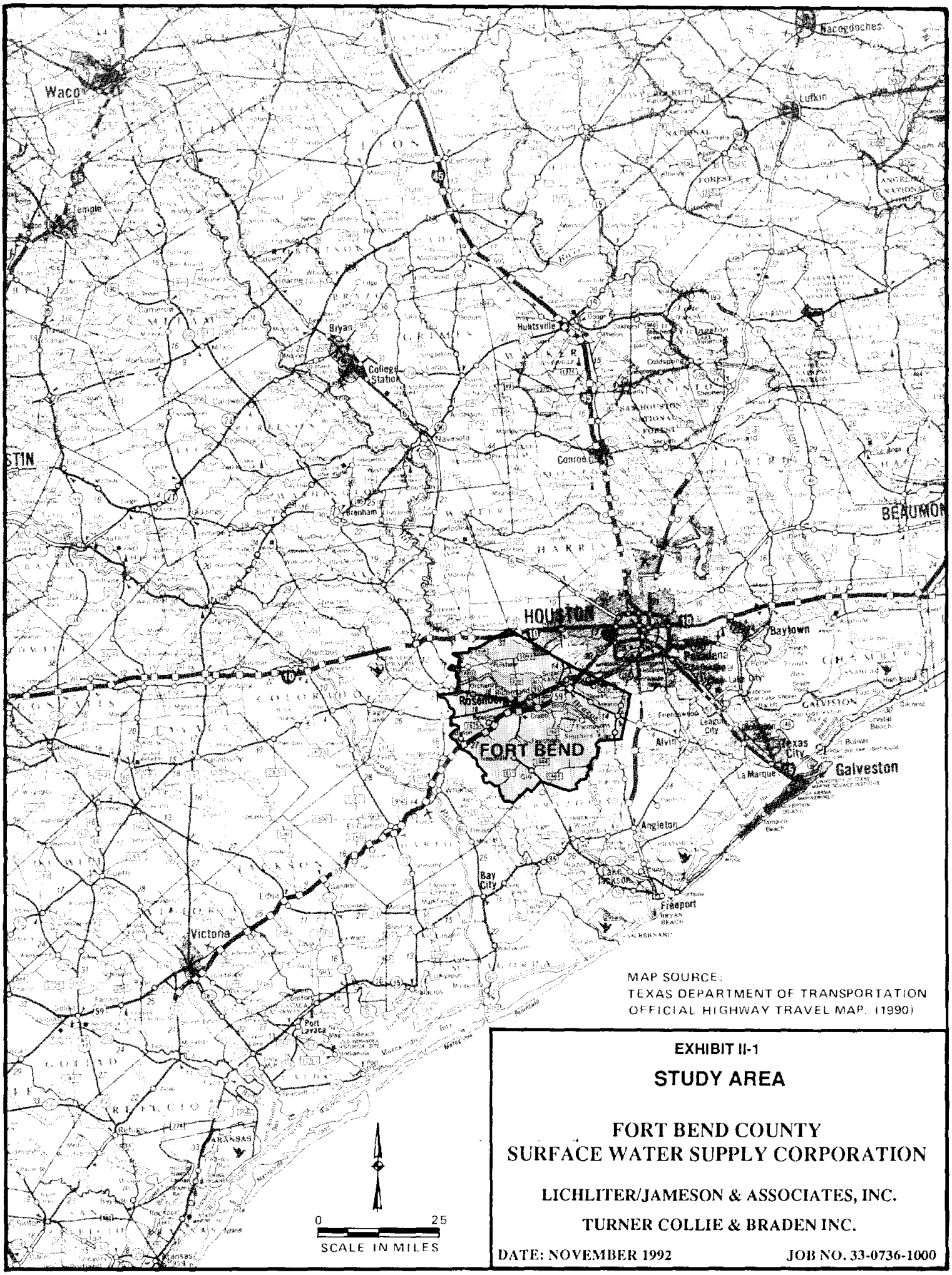
SECTION II - BACKGROUND

STUDY AREA

The planning area for this study coincides with the geographical boundary of Fort Bend County in southeast Texas as shown on Exhibit II-1. The county encompasses approximately 876 square miles and includes the cities of Arcola, Fulshear, Kendleton, Meadows, Missouri City, Needville, Orchard, Pleak, Richmond, Rosenberg, Simonton, Stafford, and Sugar Land. Also included are the towns of Beasley and Thompson, various municipal utility districts, and those portions of the cities of Houston and Katy which lie within Fort Bend County.

SUBSIDENCE

Gulf Coast aquifers underlying Fort Bend County currently supply all municipal demand in the county as well as various irrigation, agricultural, and industrial demands. The overall rate of groundwater withdrawal in the Houston, Texas metropolitan area, which includes portions of Fort Bend County, has resulted in the lowering of potentiometric levels which in turn has caused dewatering and consolidation of the underlying clay layers within the aquifers. This consolidation has resulted in land subsidence of as much as three feet in some of the most populous areas of Fort Bend County during the period 1964 to 1990. Increased flooding, ground faulting, and deterioration in water quality in portions of the region, which includes the Houston, Texas metropolitan area and particularly the coastal areas along Galveston Bay in eastern Harris and Galveston counties, have resulted from subsidence of the land surface. The Phase 1 Report presented the historical rate of subsidence in Fort Bend County in greater detail.



MAP SOURCE:
TEXAS DEPARTMENT OF TRANSPORTATION
OFFICIAL HIGHWAY TRAVEL MAP. (1990)

EXHIBIT II-1

STUDY AREA

FORT BEND COUNTY SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: NOVEMBER 1992 JOB NO. 33-0736-1000

SECTION III - EXISTING AND PROJECTED CONDITIONS

GENERAL

According to the United States Census Bureau, 225,421 persons lived in Fort Bend County in 1990. This population represented a municipal water demand of 37 million gallons per day (mgd), which is a per capita usage rate of 164.1 gallons per capita per day(gpcd). Population projections for the county, based on land availability, projected growth rates, and planned developments, estimate a population of 680,804 persons in year 2030. Approximately 60 percent of this population is expected to reside in Area A, which is shown as Exhibit III-1. This area includes the major cities and outlying water districts that are experiencing rapid growth rates, but does not include areas within the corporate limits of Houston. These areas lie east of the Brazos River and adjacent to the City of Houston.

Using the 1990 municipal demand factor of 164.1 gallons per capita per day, the projected water demand for Fort Bend County will reach 112 mgd in year 2030. Of this total, 67.1 mgd is expected to be required to serve the population located in Area A.

A second area of population growth and interest was identified as Area B, shown in Exhibit III-2 Area B includes not only the populations of Area A but also adds a large land area that currently is undergoing rapid conversion from agricultural usage to residential development. This area includes several master planned communities and represents a large amount of potential population growth. Populations projected for Area B for the year 2030 are 74.8 percent of the total county population, with a projected water demand of 83.5 mgd. Agin, those areas within the corporate limits of the City of Houston were excluded in calculating the demands for Area B.

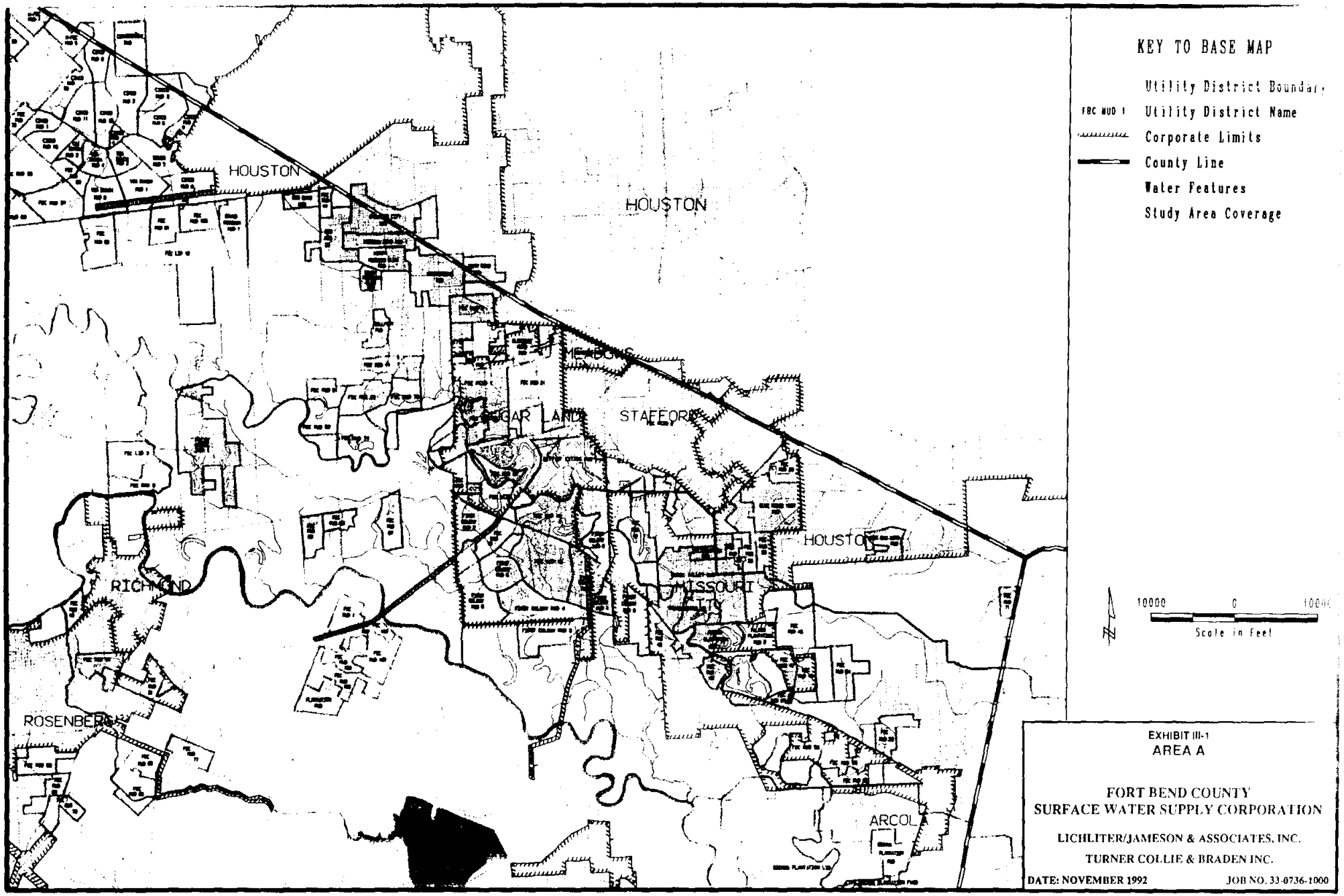
PUBLIC WATER SYSTEM CONFIGURATION

Rosenberg, the largest city in Fort Bend County other than the City of Houston, has a population of just over 20,000 persons. The total population of the county is distributed fairly evenly between cities and special districts.

Texas Water Commission (TWC) records currently list 165 separate entities as operating public water systems in Fort Bend County. Of that number, 72 are classified as community-type systems serving municipalities, water districts, mobile home parks, apartment complexes, and other residential housing units. The remaining 94 systems either serve non-community systems or are systems which do not serve residential housing units for permanent occupancy. Examples of such systems include grocery stores and

other commercial establishments, industrial facilities, hotels, motels, campgrounds, etc. Individual rural water supply needs are served by individual wells.

None of the water supply entities discussed above serves a substantial population outside its political boundaries. Although some interconnections do exist between these systems, most are for emergency use only. In addition, some development is occurring where a number of special districts are formed and one district is chosen as the supply district. This district then supplies water and wastewater collection and treatment facilities to the rest of the districts in the development. Again, no service is provided outside the boundaries of that multiple-district area.


KEY TO BASE MAP
Utility District Boundary
FBC MUD 1
Utility District Name
Corporate Limits
County Line
Water Features
Study Area Coverage
HOUSTON
HOUSTON
SUGAR LAND
STAFFORD
HOUSTON
RICHMOND
MISSOURI CITY
ROSENBERG
ARCOLA
10000
0
10000
Scale in Feet
EXHIBIT III-1
AREA A
FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION
LICHLITER/JAMESON & ASSOCIATES, INC.
TURNER COLLIE & BRADEN INC.
DATE: NOVEMBER 1992
JOB NO. 33-0736-1000

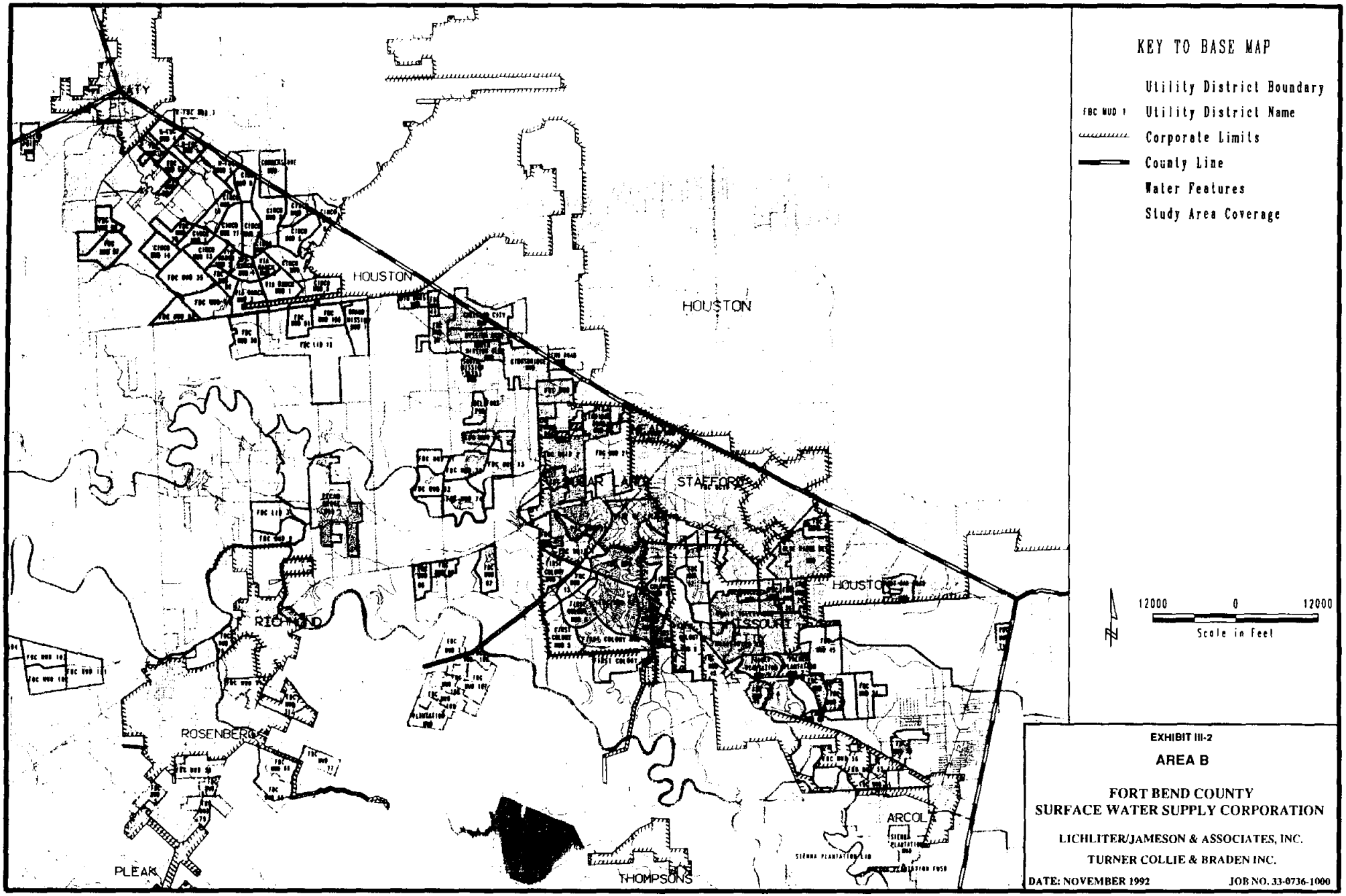


EXHIBIT III-2

AREA B

FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: NOVEMBER 1992 JOB NO. 33-0736-1000

SECTION IV - IMPACTS ASSOCIATED WITH UNCONTROLLED GROUNDWATER USE

GENERAL

The Phase 1 report included extensive discussion of problems associated with continued use of groundwater in Fort Bend County and surrounding areas. Continuing to operate individual water supply facilities will continue the problems associated with overdrafting of the groundwater resource. Each negative impact of such overpumpage is considered separately in the following paragraphs. These impacts were summarized here and are described in more detail in the Phase 1 report.

DECLINE IN WATER PRESSURE IN AREA WELLS

The primary water-bearing sands used for production of potable water in Fort Bend County include the Chicot and Evangeline layers of the Gulf Coast aquifer. These same sands are shared with Harris County and the City of Houston. In 1986, total groundwater use by all entities in Harris County exceeded 115 billion gallons of groundwater for public drinking water supply needs. By comparison, Fort Bend County used 9.1 billion gallons for public drinking water supply needs.

Pumpage of groundwater in Harris County has resulted in a significant decline in potentiometric levels in the aquifer. This decline in water levels has resulted in a corresponding land subsidence to varying degrees across the region, including Fort Bend County. The Harris-Galveston Coastal Subsidence District (HGCSD) has initiated a regulatory plan for conversion to surface water throughout Harris and Galveston counties. Since no formal agreement exists between Harris and Fort Bend counties to comply with groundwater conservation, and Fort Bend County is not included in the HGCSD regulatory plan, conditions used in this study assumed no regulatory plan in place.

The disparity in groundwater use between Harris and Fort Bend counties exemplifies the interdependence between groundwater use in Harris County and potentiometric level declines in wells in Fort Bend County. Projections of water demand have been used to predict static water pressure declines in underlying aquifers. Without implementation of the HGCSD regulatory plan in Harris County, potentiometric levels in the Evangeline aquifer in the northeastern portion of Fort Bend County are expected to drop between 150 and 200 feet between the years 1990 and 2030. A decline of 100 feet is expected in the Richmond/Rosenberg area. Se Exhibits VI-2 and VII-1 of the Phase 1 Report for additional information.

This represents the "worst case conditions" scenario, where all public supply needs in Fort Bend County and western Harris County will continue to be supplied by groundwater throughout the study period.

LAND SUBSIDENCE

One of the most important aspects of decreased aquifer potentiometric levels is the potential for land subsidence. This decrease in elevation of the land surface occurs as the dewatered aquifer consolidates. These effects are irreversible, as neither the aquifer capacity nor the land surface elevation can be restored once the aquifer structure has compacted.

Subsidence of the land surface has the potential for enlarging areas of flooding under each of the commonly classified stormwater levels (2-, 5-, 10-, 25-, and 100-year storm events). One of the goals of this study is to provide some quantification of the costs associated with unrestricted groundwater pumpage levels in Fort Bend and Harris counties. Increased costs were expected in the enlargement of the flooding area for a given storm event and also as a result of the effects on existing levees as land subsidence decreased the available freeboard with which they were designed. The section of the Phase 1 study which addressed this issue concluded that annual capital costs for levee upgrade would be $284,000. Average annual increases in flood damage would be approximately $2,400,000. These costs were based on the "worst case condition" scenario described previously.

Other possible but unquantifiable impacts could include reduced property values and decreased tax revenues as a result of the expanded floodplain. However, areas currently undeveloped are generally carried on the tax rolls based on their agricultural valuation, so a significant decrease from that value would be unlikely. Houses in existing subdivisions which are not now but could in the future be included in the flood plain would be candidates for some form of protection to avoid devaluation. The most significant impact would be felt on vacant subdivided lots, some of which could never be built upon unless some form of protection was constructed. If significant property devaluation was anticipated, some alternate means of protection could be provided to avoid that devaluation. Dollars invested in protection measures should reduce estimated damage costs, provide increased stability and possibly increase property values and tax revenues.

INCREASES IN PUMPING COSTS

The aquifer system supplying Fort Bend County is a confined aquifer system whose water is under pressure. This type system results in lower pumping requirements. Because the water is under pressure, the water will rise to a defined potentiometric surface in the well. The difference in elevation between the potentiometric surface and the surface elevation is the distance the pump must move the water. As

potentiometric levels in the aquifer decrease, this difference in elevation increases. This increase requires more pumping to bring water to the surface. As the amount of lift needed to bring water to the surface increases, existing pumps may have to be modified by adding more stages, or may have to be replaced with pumps of a higher head capacity. Some wells may have to be abandoned since the declining potentiometric levels will cause some of the screens to be no longer submerged. By year 2030, the various water supply entities in the county will have spent $12 million on existing wells, either for well replacement or for well workover. Cost breakdowns for these items can be found in Table VI-3 of the Phase 1 Report. New wells will be required to supply growing demands. The cost of providing new wells will bring the total cost of well facilities to $14.5 million based on TWC minimum water supply requirements. Operating, maintenance, and energy costs will be greater, because water must be lifted from a greater depth.

FAULTING

Damage from faulting also is associated with land subsidence. Three faults currently known to exist in northern Fort Bend County are the Addicks, the Clodine, and the Renn faults. (See Exhibit VI-2 of the Phase 1 Report). These faults exist in the most populated area of Fort Bend County and in the area anticipated to have the most significant growth. Movements of these faults may be accelerated by the projected water level declines. Such movement may result in damage to roads, levees, and other public works structures, as well as to residential housing. Structures already located over these fault zones will continue to have problems from fault movement. However, the mapping of the location of these faults will prevent further construction from occurring over them. As a result, damage costs will be limited to existing structures and will be somewhat limited to the value of those structures. Damage to streets, sidewalks, and public utilities which must cross the fault zones will continue. Further research into the relationship between subsidence and increased faulting would be necessary before these damage amounts can be quantified adequately.

WATER QUALITY

Groundwater in Fort Bend County currently is of high quality with no significant historical problems recorded. However, eight salt domes are dispersed randomly throughout the county, as shown in Exhibit VI-2 of the Phase 1 Report. These concentrated salt areas represent a potential water quality problem caused by water moving into and through these domes as a result of the declining water pressures. A second water quality concern is the appearance of radioactive constituents in groundwater, which has occurred in portions of neighboring Harris County. Although no such problem has been recorded in Fort Bend County at present, the possible appearance of radioactive constituents remains a potential concern.

DUPLICITY OF WATER PRODUCTION FACILITIES

The Phase 1 Report determined that the current method of constructing water production, storage, and pressure maintenance systems for the residents of Fort Bend County is based on individual systems supplying all of the needs of the residents within their jurisdiction. This is generally done without regard to similar facilities located on adjacent properties. As a result, there is a considerable duplication of facilities over and above those amounts actually needed to serve the combined demands of the area. Texas Water Commission rules require that systems provide a minimum of 0.6 gallons per minute of well production capacity per active connection. In addition, for systems of 250 or more connections TWC requires 2 sources of supply, either a second well or an interconnection with another system which has the capacity to serve water under emergency conditions. To further complicate the situation, a large portion of northeast Fort Bend County is located within the extraterritorial jurisdiction(ETJ) of the City of Houston. In addition to meeting the TWC requirements, systems in the City of Houston's ETJ must also meet the City's minimum well size of 1000 gallons per minute. If four districts are formed in a particular area and each district has the potential to sell 100 homes per year, then it will take 4 years for the districts to build up enough connections to fully utilize the capacity of one 1000 gpm well. If these four districts each construct individual wells, then the total capacity available is 4000 gpm. It would take 16 years of development to fully utilize this amount of well capacity. However,if the districts went together to build 2 wells initially, they would be able to satisfy the TWC rules for 2 sources of supply to allow them to exceed 250 connections, and they would be able to operate for 8 years without having to add more well capacity. Collectively, they would save the cost of constructing the 2 additional wells for 8 years. Using an approximate cost of $400,000 per well, 8% interest, and a 20 year payout period, the annualized cost for the 2 additional wells is $81,500. During the 8 years that the wells are not needed, a savings of $650,000 would be realized, exclusive of the operational and maintenance costs that would also be incurred.

A second factor involved in development based on individual systems is that the distribution systems are designed only to provide water to the immediate subdivision area, and no facilities are included to transfer water through one area to another. As a result, there is no available means for moving bulk water from one location to another, and oftentimes even the interconnections which are made are situated in lines which are not able to adequately supply the amounts of water needed to function under emergency conditions. A redirection of some of the funds spent on duplication well facilities to provision of larger sized arterial mains and the necessary interconnections between systems to facilitate bulk water movement would allow districts to participate in regionalized planning efforts for both ground and surface water. In addition, even though the additional well capacity will eventually be needed, economies of scale in well sizing could also be realized if there were a means of distributing the water produced from such larger facilities.

SECTION V - ALTERNATIVE TECHNICAL PLANS

OVERVIEW

Possible sources of potable water to meet projected demand in the study area are groundwater, surface water, or some combination of the two. Possible types of suppliers are a regional authority, several independently operated supply systems, or individual wells to serve city, water district, or other public water system demands. Currently, Fort Bend County relies on groundwater as its source for municipal (public) supply from independent systems and individual wells. Industries primarily use surface water for their process needs, although most rely on groundwater for potable water.

Long-range planning for future water supply in Fort Bend County includes both the determination of possible water sources and the organizational method by which chosen supplies will be handled, processed, and distributed to the public. The following alternatives were evaluated in this Phase 2 study:

- Continuation of the present practice of relying solely on individual groundwater systems to serve public needs
- Regionalization of groundwater sources to serve all public water supply demands through a regional authority.
- Partial conversion of portions of the county to surface water through a regional authority.
- County-wide conversion from ground to surface water under auspices of a regional authority.

Each of these alternatives was evaluated for technical and economic feasibility.

To consider regionalization of water service, areas with the greatest population densities were defined as the basis for development of a regional authority. Areas selected for study were those previously described as Areas A and B. Statistics on population and water demands for these two areas, compared to the total for Fort Bend County, appear on Table V-1. The cost of facilities for each alternative was based on inclusion of water production facilities to serve a year 2030 population of 680,804 in Fort Bend County (for any county-wide comparisons) and to serve populations of 408,812 and 508,892 for Areas A and B, respectively. Associated water demands were projected at 111.7 mgd for the total population, 67.1 mgd for Area A, and 83.5 mgd for Area B.

ALTERNATIVE I ONE HUNDRED PERCENT GROUNDWATER USE OPERATED BY INDIVIDUAL SUPPLY ENTITIES

The Phase 1 report evaluates this alternative based on the resulting impacts of continued groundwater production in Fort Bend and Harris Counties if surface water is not developed as a potable source. This

alternative maintains the status quo, with each individual entity looking for individual solutions to area-wide problems. This option represents the economic benchmark to which other water supply alternatives were compared. If this alternative continues, the costs of the associated impacts of declining water pressure, land subsidence, faulting, and water quality can be expected to be incurred. As indicated, some of these costs are difficult to quantify, although an effort has been made to quantify costs associated with increased well pumping, workover, and replacement, as well as those associated with increased flooding.

ALTERNATIVE II REGIONALIZED GROUNDWATER

Currently, each water production entity in Fort Bend County maintains water storage (ground storage, elevated storage, or both), water production wells, and service pumps. As each system is developed, an initial water plant is installed to provide water service to prospective residents. To take advantage of lower costs per unit of installed capacity, the first increment of each plant is significantly oversized. Generally, several years of development are required to achieve usage of a majority of the plant's capacity. In the City of Houston's Extraterritorial Jurisdiction (ETJ), this is especially true, since the City requires that all water supply wells have a minimum capacity of 1,000 gpm. Based on the TWC minimum standards of 0.6 gallons per minute per connection, each well is capable of serving in excess of 1,500 connections if an interconnection with a neighboring system is secured as a second source of supply. Rate of development will determine the length of time before the well capacity is fully utilized. However, a period of 5 to 7 years from the date of construction is typical.

In systems that grow according to original projections, the overall debt load is heavy when spread across a limited number of initial connections. It is even more of a problem when a subdivision fails to grow as expected.

Surplus groundwater capacities could be utilized more effectively for the benefit of all parties if a regionalized plan were developed. Table V-2 lists a comparison of existing and required capacities for serving the existing population of Area A. TWC requirements assume a single system supplies the population of 141,300 persons. Existing well capacity for this area is twice the required capacity. A surplus capacity of 5.3 million gallons of ground storage exists in this area. With a regional plan, duplications could be reduced to achieve a more efficient production and distribution system.

A review of locations where existing public water supplies had water production facilities capable of producing more water than the utility currently needs, identified two areas from which excess water production could potentially be transmitted to new areas outside of designated service areas. Area 1 is centered in the Mission Bend, Mission Glen, and Kingsbridge MUDs and Belfort PUD area. Area 1 is

located north of U.S. 59 and Highway 90-A, along State Highway 6 near the Harris-Ft. Bend County boundary. (See Exhibit V-1.) A current excess water production capacity of 5.61 mgd was identified in this area. However, the area is anticipated to use most of this demand in the future as development continues.

Area 2 is located southeast of U.S. 59 in the Quail Valley area and services areas in and around the Quail Valley, Meadowcreek, and Palmer Plantation MUDs and the Thunderbird UD. An excess water production capacity of 13.52 mgd was identified in this area. (See Exhibit V-2.)

Under the regional groundwater approach, existing water plant facilities are connected to a common water line. Excess water production in each area would be pumped into the line for transmission to developing areas that would delay the construction of their own sources. The sizes of the lines in each loop would be determined by the maximum line sizes connecting the storage facilities to the loop and by the maximum realistic flow in the loop. Pumping facilities, appropriately sized to move the amount of surplus water available, would be located at existing storage facilities from which the water is obtained. However, these pumping facilities would be totally separate from the high-service pumps supplying the existing distribution systems. The water service lines would be extended to serve areas of likely future developments. Conversely, as additional water production facilities are constructed in newly developing areas, these facilities also would be connected to these extended lines. This pattern would result in improved system reliabilities and promote additional expansion of the outer service area in a more cost effective manner.

The probable costs of sharing water production for these two areas are shown on Table V-3. Table V-4 compares these probable costs with the anticipated costs for new wells to serve newly developing areas instead of using available excess capacity.

Providing water to new developments by using this regional approach would allow greater flexibility for area development. Development could occur anywhere in the expanded service area without a single area being overburdened by the costs associated with constructing a well which itself would have excess capacity. By using available water supplies, new well costs would be deferred to a later date. Also, the mechanism would be in place for future regionalization using surface water supplies.

This alternative would allow increased control of groundwater withdrawal and, possibly, subsidence. However, construction of interconnections between existing lines would have to be completed, and a regional authority created to monitor production and to manage capacities to meet the needs of the expanded service area. As Table V-4 indicates, the cost of regionalizing would greatly exceed the cost of

drilling new wells, even without the costs of the interconnections and the formation of the regional authority. Regionalization would provide additional benefits from increased reliability and economies of scale in new production facilities.

ALTERNATIVE III CONJUNCTIVE USE OF GROUNDWATER AND SURFACE WATER

Alternative III involves a regional plan that would include partial conversion to surface water. Two areas of projected high population density were considered in the analysis of this alternative. The first area, previously described as Area A, encompasses approximately 16 percent of the land area of Fort Bend County. Area A includes Stafford, Missouri City, Lake Olympia, First Colony, Sugar Land, Pecan Grove, and Mission Bend. Referring again to Table V-1, it is noted that based on land availability and a population density factor, the projected ultimate population for the service area of Area A is 478,377 persons with a demand of approximately 78.5 mgd. Since the population of the area will be approaching full development (85 percent fully developed by year 2030), the water purification plant and the distribution system will be designed for full development.

The second portion of Alternative III examines the provision of treated surface water to an area that includes all of Area A, as well as additional acreage that, while largely undeveloped at present, represents a high potential for development of high-density housing. The primary reason for including this large portion of undeveloped land is to provide flexibility to any regionalization plan. Including undeveloped and partially developed land areas allows the regional authority to proceed with regionalization either by supplanting sources already established (with the attendant duplicated costs of groundwater and surface water production for each area) or beginning development with surface water supplies, or presently existing wells supplanted by surface water, in undeveloped land areas. Using the same factors referenced for Area A, the projected ultimate population for Area B is 742,274. Although the population in year 2030 represents only 68 percent of the ultimate population for this area, the preferred plant phasing process will be accomplished in increments that can be fully utilized from start-up by replacing existing wells. As indicated for Area A, older wells could be retired and wells in good condition could be maintained for peaking purposes and to supply new growth. This would eliminate the need for additional wells in the new growth areas and avoid the associated costs of such duplication.

HGCSD has a regulatory action plan in which both Harris and Galveston counties partially convert to surface water. Eighty and ninety percent conversions are required for each of seven specific areas. The schedule requires a specified percentage conversion to occur by specified years. Any growth in demand occurs on groundwater until a second specified year. At that time, the area again is required to convert the designated percentage of its demand to surface water.

Fort Bend County has no regulatory plan for conversion from groundwater and therefore no specified percentage of conversion. In the absence of a mandatory percentage, a goal of limiting groundwater withdrawal to the amount used in 1990 was adopted in the alternatives analysis.

To meet objectives of Alternative III, namely to hold groundwater consumption to 1990 levels, a surface water plant of 60 mgd will be required by the end of the planning period in year 2030. The plant would be constructed in three 20-mgd increments phased into operation to meet the schedule of demand for Area A, as shown on Exhibit V-3. Similar phasing to meet the schedule of demand for Area B is shown on Exhibit V-4.

Phased construction of the surface water treatment plant allows the entire plant output to be used upon completion of each phase by replacing the existing well supplies. Wells near the end of their useful life would be abandoned and the remaining wells used to provide water for continued growth and for peaking purposes. Construction of the initial phase is scheduled for year 2000. This phase of the project is the same for Service Area A and for Service Area B. A 20-mgd plant will be constructed to serve the Sugar Land and First Colony areas. In the year 2000, the projected average-day water demand in these areas is 22.6 mgd. Existing groundwater wells will supply peak demands. Demand is expected to reach 24.3 mgd by the year 2010. Therefore, growth within the service area of the surface water treatment plant will rely on surface water. This will be accomplished by using the existing wells which were replaced by the surface water treatment plant to supply growth outside that service area.

Phase II, which would expand the treatment plant capacity to 40 mgd, is scheduled for year 2010. Depending on the pattern of development, the service area could be expanded to serve Missouri City, Stafford-FB WC&ID No. 2, and the Mission Bend area under the Area A option. Alternatively, if population growth occurs west of Sugar Land, the plant may be expanded to serve this area. Phase III, a final 20-mgd increment, is scheduled tentatively for completion at the end of the planning period in year 2030. This final phase will bring plant capacity to a total of 60 mgd. In year 2030, Sugar Land and First Colony will represent a demand of 25.4 mgd; Missouri City and Stafford will represent a demand of 15.8 mgd. The transmission network that would be needed to supply water to the Phase 1 and Phase 2 portions of Area A under Alternative III are shown in Exhibit V-5. The Phase III additions are not shown since they would not be in place until the end of this planning period and since growth would dictate the location of these facilities.

Under the Area B option of Alternative 3, the timing and location of additional areas being converted to surface water are much more dependent upon area growth projections and the direction of growth movement. Choices for conversion under the second increment of plant capacity would include the

Missouri City area, the area to the west of Sugar Land, as well as the area to the northwest represented by Cinco Ranch and Via Ranch. Again, this option offers direct comparisons between developing surface water distribution systems initially compared to retrofitting areas now using groundwater to enable them to use surface water.

Raw Water Source

The source of raw water is the Brazos River. Although water from this river is of poor quality at times throughout the year, the costs of bringing raw water from either the Trinity or San Jacinto watersheds are prohibitive. The supplier of surface water will be the Gulf Coast Water Authority's (GCWA) canal system. Existing availability from the canal is 60 mgd at a cost of $111.00 per million gallons ($36.17/acre-ft). This corresponds to a cost of $0.111 per thousand gallons.

Location of Surface Water Plant

The location of the surface water plant is dependent upon numerous factors. Ideally, the plant would be located near the service area and the raw water source. Accessibility also is a consideration. Because sludge disposal is to be located on site, soil characteristics must be considered. The surrounding land use should not be residential or commercial for aesthetic reasons. Cost of land also is a factor.

Two sites have been selected for consideration. A tract of land currently owned by the Texas Department of Criminal Justice (TDCJ) lies west of Sugar Land and adjacent to the canal system. This tract allows for expansion of service west of the initial service areas of Sugar Land, First Colony, Missouri City, and Stafford.

The second tract is centrally located to Sugar Land, First Colony, Missouri City, and Stafford. This triangular tract of land adjacent to Canal "A" has limited room for expansion, but is located to serve the surrounding areas efficiently. Some expansion of the canal may be required to transmit the additional amount of raw water.

The recommended location is the tract owned by the TDJC. A surface water treatment facility on this tract can be expanded readily to serve areas in north central Fort Bend County. The approximate location of the plant is shown on Exhibit V-5. Raw water transmission costs will be minimal. No major canal renovations are required.

Raw Water Quality Improvement

A statistical analysis, completed by the U.S. Geological Survey (USGS) on data resulting from analyses of the Brazos River at Richmond, Texas from October 1967 to August 1986, indicated that concentrations of chlorides in Brazos River water are above 240 mg/l approximately five percent of any given year, or 18 days. Although this level is below the 300 mg/liter specified by TWC for chloride in drinking water, the level of 240 mg/l provides an additional margin of safety which assures statistically that the level measured will remain below 300 mg/l at all times. As a result of this quality problem, any surface water alternative will require a reserve source of raw water supply for an 18-day period each year. This percentage was derived statistically; actual duration could be either more or less than 18 days annually. These 18 days are not necessarily consecutive, nor can they be readily predicted. Therefore, a flexible interim source must be available.

Several alternatives were evaluated as possible solutions to this intermittent problem. Construction of a termination storage facility sized to store an 18-day supply of raw water was investigated, then deleted from the list of possibilities because of cost. An alternate source of surface water was not considered since the costs for transmitting raw water from the Trinity or San Jacinto river were high enough to preclude both rivers as sources for total plant use. The possibility of purchasing treated water from the City of Houston was considered, but the inability of the City of Houston's water lines to transmit the required quantity of water eliminated this option. The only economical alternative available is to mix groundwater with surface water to supply the demand. The maximum chloride concentration of raw surface water was 370.0 mg/l for the period 1967 to 1986. Average concentrations of chlorides in the Evangeline aquifer, from which the majority of water for municipal use is withdrawn, are 57.9 mg/l. The maximum concentration of chlorides in groundwater was calculated to be 130 mg/l based on the average plus two standard deviations (2*36.3 mg/l). These maximum concentrations will require a maximum ratio of 1:1 groundwater to surface water to achieve an overall chloride concentration of less than 250 mg/l.

Mixing prior to entering the surface water treatment plant will help avoid taste and odor problems as well as high trihalomethane levels that could occur from mixing the surface and ground waters after treatment and upon entry to the distribution system. As an alternative, the water could be mixed in the clearwell of the surface water treatment plant if pilot testing shows that this can be done without creating problems. This alternative would save the cost of unnecessary surface water treatment for the groundwater.

Groundwater required to be mixed with surface water can be supplied by collecting water from existing wells or by drilling new wells. If water were to be collected from existing wells and transported to the plant,

costs would include pumping and line costs. As wells must be replaced, these costs could be lowered by locating future wells close to the plant and to each other.

The other alternative is to drill new wells to supply demand during the period of high chlorides. One additional cost with this option is that wells must be operated at least one time per week to maintain them in ready status. Assuming an average well capacity of 1,500 gallons each, five new wells must be drilled to supply the required amount for a 20-mgd plant. To supply the necessary amount for a 40-mgd plant, five additional wells must be drilled. A total of 14 wells must be drilled for a 60-mgd plant.

Transmission System

Transmission lines were designed to transport treated water from the purification plant to each storage location in the service area. The treatment plant is assumed to be located on a tract of land east of Hull Field. The tract currently is owned by TDCJ. Water will be pumped at low pressure at a maximum velocity of 5 feet per second through the transmission lines and repumped at the storage locations for distribution. Each entity will be responsible for distribution to users in the entity's service area.

The initial phase is planned to serve Sugar Land and First Colony with 20 mgd of surface water. In year 2000, 20 mgd is the average demand which has been projected for this area. Line sizes for this phase are sized to serve Stafford and Missouri City, eventually.

The second phase was assumed to serve Stafford and Missouri City. This area, combined with Sugar Land and First Colony, will require 40 mgd in year 2030. A third phase is planned to serve the area west of Sugar Land, including the Cinco Ranch area. In year 2030, the expansion will serve an additional 20 mgd from the plant located east of Hull field.

The cost for each component of Alternative 3A is presented on Table V-5. Costs per thousand gallons of water treated are shown on Table V-6. For Service Area A and Service Area B, only the costs of the first two increments of plant capacity are included, since the final increment of plant capacity is not scheduled to go on line until the end of the planning period.

Alternative III - Area B

The phasing schedule for this alternative is the same as the schedule for Alternative III-A. Benefits of a larger service area are the greater possibility for expansion and flexibility in scheduling and determining which areas to serve most economically. The regional authority will determine, based on direction and

amount of growth, which demands are met by surface water and which remain on groundwater. This alternative allows for future plant expansions to serve a greater water demand.

Phase 1 and possibly Phase 2 portions of the surface water treatment plant would be constructed in the same manner and at approximately the same time intervals as under Alternative III-A. The difference between the two alternatives would occur if the rapidly growing areas to the west that were added to Area A overshadowed the growth taking place in the Missouri City, Stafford-Fort Bend County WCID #2 and the Mission Bend area over the next 20 years. A second possible difference could occur if a determination is made by the management authority that it is more cost effective to move the surface water to the rapidly developing areas, or to serve them with water from wells replaced by surface water through a transmission line. This plan would eliminate the need for drilling wells in these areas and avoid the duplication of supplies that occurs in areas already developed. Development in the west can be planned to occur on surface water from the outset.

ALTERNATIVE IV COMPLETE CONVERSION TO SURFACE WATER

A county-wide surface water distribution system does not appear to be economically feasible at this time because of the large land area encompassed by the county, and because of the population concentrated in the northeast portion of the county. For the current distribution of population and demand, a smaller regional area is more economically appealing than a county-wide service area. As the county continues its growth, and demand becomes more evenly distributed, a county-wide plan may become more appealing.

18-Jan-93

TABLE V-I
FORT BEND COUNTY POPULATION AND WATER DEMAND PROJECTIONS

HGCSD PROJECTIONS BASED ON 1990 CENSUS DATA

1980 CENSUS TRACT	1990 DEMAND				2030 DEMAND				MAXIMUM DEMAND			
	1990 POP.	TOTAL DEMAND	AREA A	AREA B	2030 POP.	TOTAL DEMAND	AREA A	AREA B	MAXIMUM POP.	TOTAL DEMAND	AREA A	AREA B
70101	1,779	0.29	0.29	0.29	13,056	2.14	2.14	2.14	16,092	2.64	2.64	2.64
70102	11,910	1.95	1.95	1.95	26,819	4.40	4.40	4.40	26,819	4.40	4.40	4.40
70103	16,519	2.71			28,366	4.65			28,366	4.65		
70104	9,843	1.62			11,877	1.95			11,877	1.95		
70105	10,126	1.66	1.66	1.66	18,369	3.01	3.01	3.01	42,632	7.00	7.00	7.00
70106	17,217	2.83	2.83	2.83	38,016	6.24	6.24	6.24	79,723	13.08	13.08	13.08
70107	1,460	0.24			7,009	1.15			114,637	18.81		
70201	2,994	0.49	0.49	0.49	9,203	1.51	1.51	1.51	9,203	1.51	1.51	1.51
70202	14,966	2.46	2.46	2.46	28,854	4.74	4.74	4.74	28,854	4.74	4.74	4.74
70203	19,609	3.22	3.22	3.22	60,876	9.99	9.99	9.99	60,876	9.99	9.99	9.99
70204	1,770	0.29	0.29	0.29	31,347	5.14	5.14	5.14	31,906	5.24	5.24	5.24
70301	30,117	4.94	4.94	4.94	126,355	20.73	20.73	20.73	126,355	20.73	20.73	20.73
70302	17,480	2.87	2.87	2.87	33,869	5.56	5.56	5.56	33,869	5.56	5.56	5.56
70303	9,935	1.63	1.63	1.63	22,048	3.62	3.62	3.62	22,048	3.62	3.62	3.62
70400	2,338	0.38		0.38	42,187	6.92		6.92	149,643	24.56		24.56
70500	2,669	0.44		0.44	57,983	9.51		9.51	114,254	18.75		18.75
70600	3,009	0.49			5,458	0.90			337,525	55.39		
70701	11,093	1.82			22,225	3.65			22,225	3.65		
70702	2,569	0.42			12,659	2.08			16,738	2.75		
70703	4,014	0.66			21,664	3.56			28,588	4.69		
70800	279	0.05			1,149	0.19			187,777	30.81		
70901	2,841	0.47			5,560	0.91			5,697	0.93		
70902	9,649	1.58			16,175	2.65			18,700	3.07		
70903	2,023	0.33			4,033	0.66			117,021	19.20		
71001	5,506	0.90			11,949	1.96			14,486	2.38		
71002	2,997	0.49			5,975	0.98			193,307	31.72		
71100	1,546	0.25			1,887	0.31			246,171	40.40		
71200	1,326	0.22			1,619	0.27			203,046	33.32		
71300	4,741	0.78			8,600	1.41			309,382	50.77		
71400	3,096	0.51			5,616	0.92			361,053	59.25		
	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0
	225,421	36.99	22.63	23.45	680,804	111.72	67.09	83.52	2958870	485.55	78.50	121.81
PERCENT OF YEAR TOTAL			61.2%	63.4%			60.0%	74.8%			16.2%	25.1%
PERCENT OF MAX. DEMAND			4.7%	4.8%			13.8%	17.2%			16.2%	25.1%

NOTE: 164.1 GALLONS/CAPITA/DAY WAS USED TO CONVERT POPULATION TO DEMAND
THIS NUMBER WAS BASED ON 1990 CONSUMPTION AND POPULATION FIGURES

TABLE V-2
GROUNDWATER SUPPLY FACILITIES
AREA 'A'

	EXISTING CAPACITY	CAPACITY REQUIRED BY TWC
POPULATION SERVED	141,269	
WELL CAPACITY	56,500	28,100
GROUND-STORAGE CAPACITY	23.7 million gallons	18.4 million gallons
ELEVATED-STORAGE CAPACITY	6.75 million gallons	5.0 million gallons
SERVICE PUMPING CAPACITY	97,900	45,900

TABLE V - 3
COST ESTIMATE FOR PRELIMINARY REGIONALIZATION OF EXISTING GROUNDWATER SUPPLIES IN FORT BEND COUNTY

AREA 1 (MISSION GLEN, KINGSBRIDGE, BELLFORT MUDs) - NORTH OF US 59

ITEM	UNIT	NUMBER	UNIT COST	UNIT COST	TOTAL COST
MAIN LOOP:					
16 IN. LINE	FT	42200	$50.00	$2,110,000	
12 IN. LINE	FT	10400	$27.00	$280,800	
8 IN. LINE	FT	1000	$8.50	$8,500	
					$2,399,300
SERVICE LINE:					
12 IN. LINE	FT	42400	$27.00	$1,144,800	$1,144,800
TRENCH SAFETY	FT	96000	$0.50	$48,000	$48,000
PUMPS					
520 GPM	EA	1	$11,650	$11,650	
700 GPM	EA	1	$13,200	$13,200	
725 GPM	EA	1	$13,300	$13,300	
925 GPM	EA	1	$14,000	$14,000	
1050 GPM	EA	1	$14,000	$14,000	
					$66,150
METERS:					
8 IN. METER	EA	1	$680	$680	
12 IN. METER	EA	4	$760	$3,040	
					$3,720
		AREA 1 - NORTH OF US 59			$3,661,970

AREA 2 (QUAIL VALLEY AREA) - SOUTH OF US 59

ITEM	UNIT	NUMBER	UNIT COST	UNIT COST	TOTAL COST
MAIN LOOP:					
24 IN. LINE	FT	58500	$64.00	$3,744,000	
16 IN. LINE	FT	5300	$50.00	$265,000	
12 IN. LINE	FT	9900	$27.00	$267,300	
8 IN. LINE	FT	2100	$8.50	$17,850	
					$4,294,150
SERVICE LINE:					
16 IN. LINE	FT	33600	$50.00	$1,680,000	$2,033,700
12 IN. LINE	FT	13100	$27.00	$353,700	
TRENCH SAFETY	FT	122500	$0.50	$61,250	$61,250
PUMPS					
300 GPM	EA	1	$11,600	$11,600	
550 GPM	EA	1	$11,650	$11,650	
700 GPM	EA	1	$13,140	$13,140	
900 GPM	EA	1	$14,000	$14,000	
1000 GPM	EA	1	$14,000	$14,000	
1250 GPM	EA	1	$16,500	$16,500	
1275 GPM	EA	1	$16,800	$16,800	
1275 GPM	EA	1	$26,000	$26,000	
					$123,690
METERS:					
8 IN. METER	EA	2	$680	$1,360	
12 IN. METER	EA	3	$760	$2,280	
16 IN. METER	EA	2	$960	$1,920	
24 IN. METER	EA	1	$4,700	$4,700	
					$10,260
		AREA 2 - SOUTH OF US 59			$6,523,050

TABLE V-4
COST ESTIMATE FOR PRELIMINARY REGIONALIZATION OF EXISTING GROUNDWATER SUPPLIES IN FORT BEND COUNTY - SUMMARY TABLE

	MAIN LOOP	SERVICE LINE	TRENCH SAFETY	PUMPS & METERS	TOTAL COST	TOTAL EXCESS CAPACITY (MGD)	TOTAL EXCESS CAPACITY (GPM)	COST FOR EQUIVALENT WELLS 1000 GPM EA
AREA 1 (Mission Glen)	$2,399,300	$1,144,800	$48,000	$69,870	$3,661,970	5.61	3896	$1,600,000
AREA 2 (Quail Valley)	$4,294,150	$2,033,700	$61,250	$133,950	$6,523,050	13.52	9388	$4,000,000
	$6,693,450	$3,178,500	$109,250	$203,820	$10,185,020	19.13	13,284	$5,600,000

TABLE V-5
COST FOR SURFACE WATER SUPPLY

	20 mgd	40 mgd	60 mgd
CAPITAL COSTS			
plant construction costs	$27,300,000	$54,600,000	$81,900,000
LAND REQUIREMENTS			
treatment plant	$320,000	$520,000	$720,000
sludge disposal	$100,000	$200,000	$300,000
CONVEYANCE LINES			
transmission system E of Hull Field	$7,734,000	$12,410,000	$24,167,000
18 DAY SUPPLEMENTAL DEMAND			
pumps	$4,080,000	$4,344,000	$5,638,000
	$347,000	$694,000	$1,042,000
SUBTOTAL - CAPITAL COST	$39,881,000	$72,768,000	$113,767,000
RAW WATER O&M COSTS			
treatment plant			
sludge disposal			
SUBTOTAL - INCLUDING O&M	$39,881,000	$72,768,000	$113,767,000
ENGINEERING (10%)	$3,988,000	$7,277,000	$11,377,000
CONTINGENCIES (15%)	$5,982,000	$10,915,000	$17,065,000
GRAND TOTAL - TRANSMISSION	$49,851,000	$90,960,000	$142,209,000

Plant E of Hull Field
1991 DOLLARS

TABLE V-6
COST FOR SURFACE WATER SUPPLY
(COST/1000 GAL)

	20 mgd	40 mgd	60 mgd
CAPITAL COSTS			
plant construction costs	$0.38	$0.38	$0.38
LAND REQUIREMENTS	$0.005	$0.004	$0.003
treatment plant sludge disposal	$0.001	$0.001	$0.001
CONVEYANCE LINES			
transmission system E of Hull Field	$0.11	$0.09	$0.11
18 DAY SUPPLEMENTAL DEMAND	$0.06	$0.03	$0.03
pumps	$0.005	$0.005	$0.005
SUBTOTAL - CAPITAL COST	$0.56	$0.51	$0.53
RAW WATER O&M COST	$0.11	$0.11	$0.11
treatment plant	$0.70	$0.53	$0.45
sludge disposal	$0.03	$0.02	$0.02
SUBTOTAL - INCLUDING O&M	$1.40	$1.17	$1.11
ENGINEERING (10%)	$0.06	$0.05	$0.05
CONTINGENCIES (15%)	$0.08	$0.08	$0.08
GRAND TOTAL - TRANSMISSION	$1.54	$1.30	$0.13

Plant E of Hull Field
1991 DOLLARS

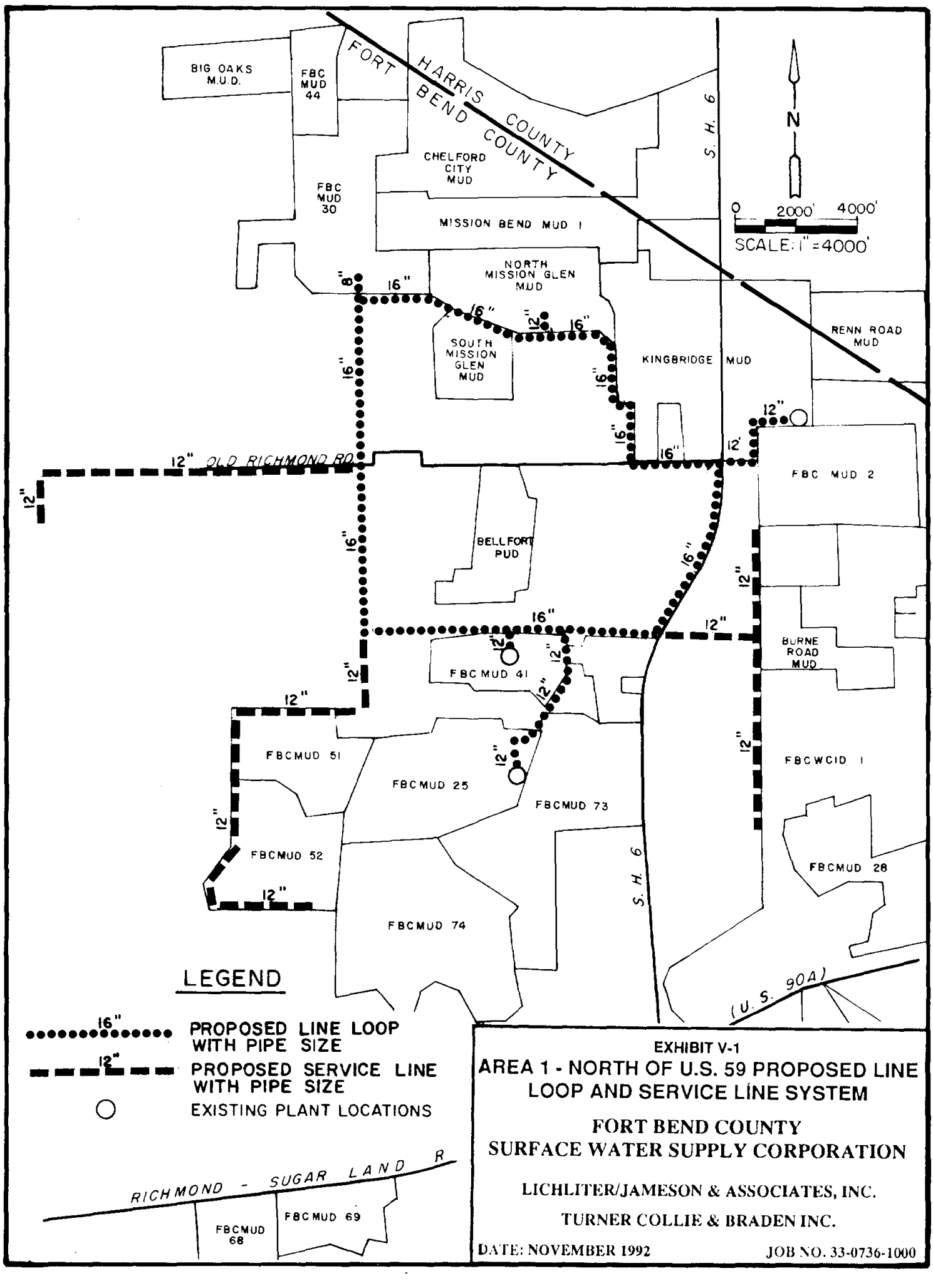


EXHIBIT V-1

AREA 1 - NORTH OF U.S. 59 PROPOSED LINE LOOP AND SERVICE LINE SYSTEM

FORT BEND COUNTY SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: NOVEMBER 1992

JOB NO. 33-0736-1000

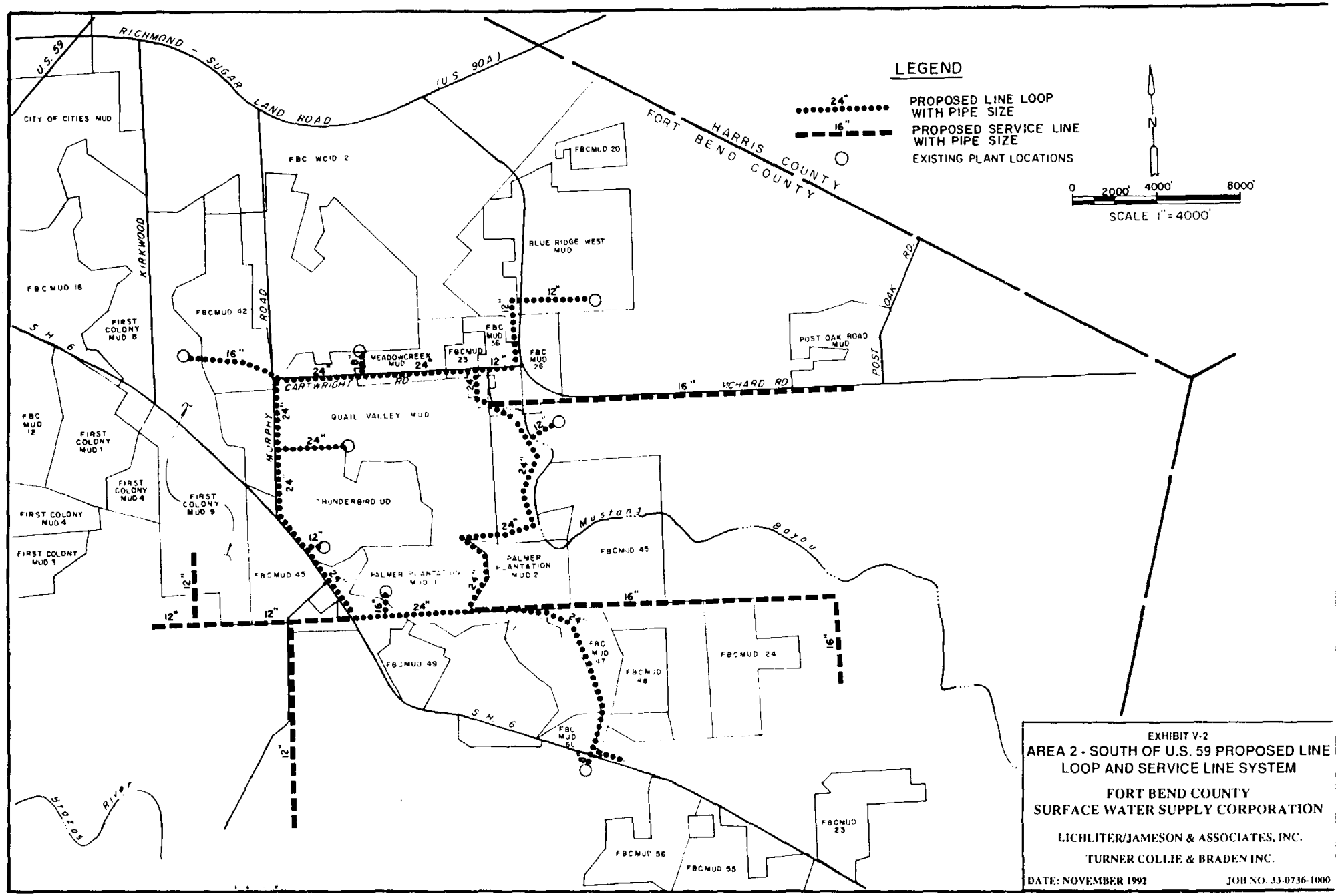


EXHIBIT V-2

AREA 2 - SOUTH OF U.S. 59 PROPOSED LINE LOOP AND SERVICE LINE SYSTEM

FORT BEND COUNTY SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: NOVEMBER 1992 JOB NO. 33-0736-1000

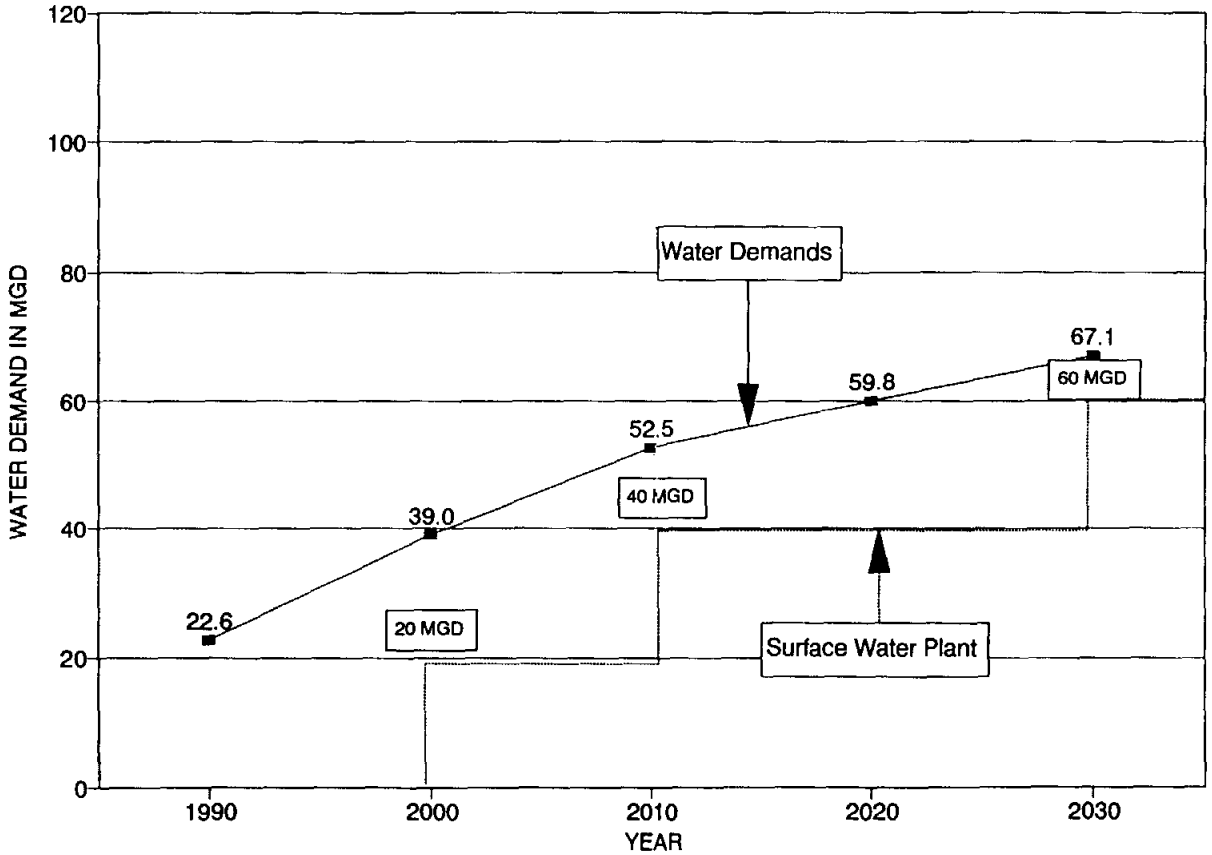


EXHIBIT V-3

ALTERNATIVE A - SURFACE WATER TREATMENT PLANT PHASING

FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: NOVEMBER 1992 JOB NO. 33-0736-1000

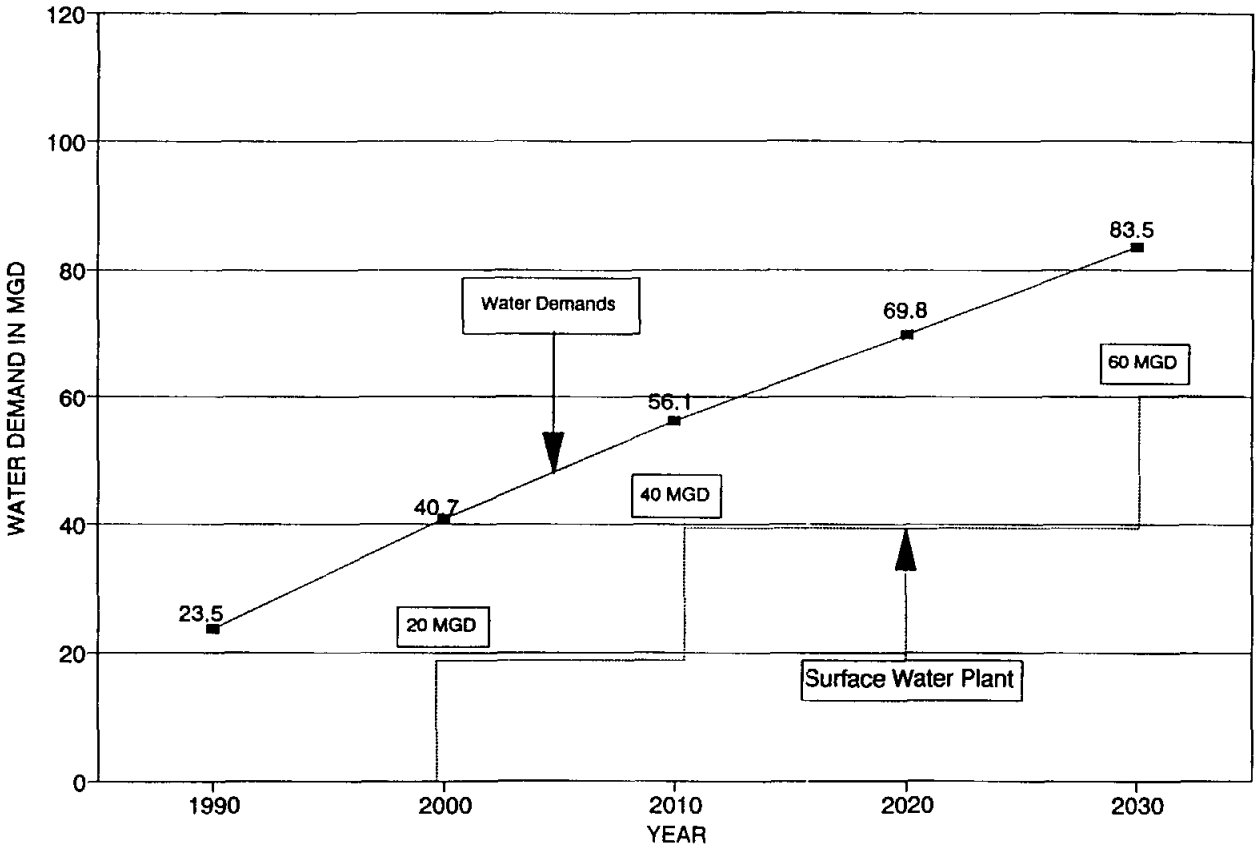


EXHIBIT V-4

ALTERNATIVE B - SURFACE WATER TREATMENT PLANT PHASING

FORT BEND COUNTY
SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: NOVEMBER 1992 JOB NO. 33-0736-1000

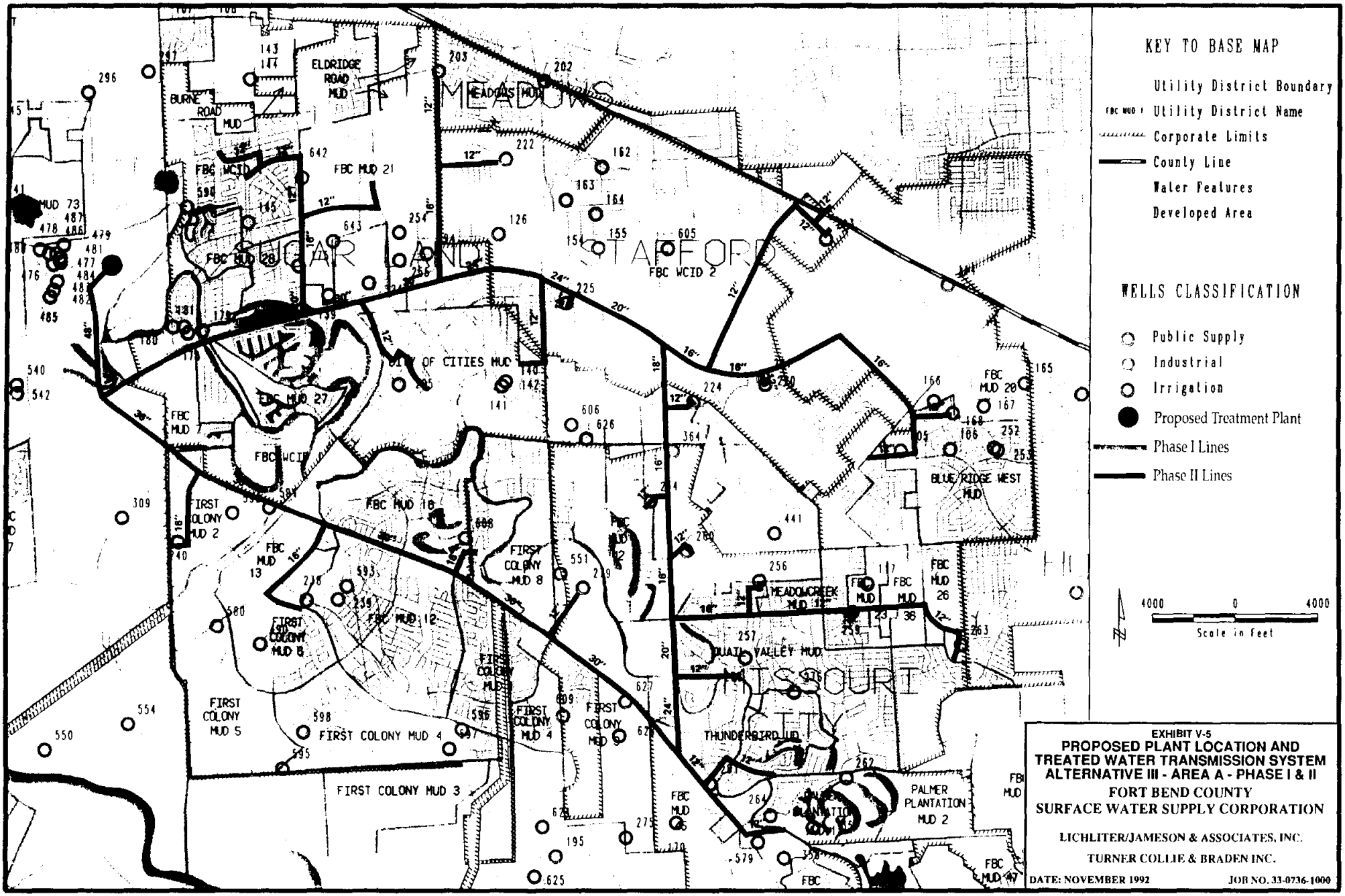


EXHIBIT V-5

PROPOSED PLANT LOCATION AND TREATED WATER TRANSMISSION SYSTEM ALTERNATIVE III - AREA A - PHASE I & II

FORT BEND COUNTY SURFACE WATER SUPPLY CORPORATION

LICHLITER/JAMESON & ASSOCIATES, INC.

TURNER COLLIE & BRADEN INC.

DATE: NOVEMBER 1992 JOB NO. 33-0736-1000

SECTION VI - COST COMPARISONS OF ALTERNATIVE COSTS OF GROUNDWATER

The cost comparisons for Alternatives 1, 2, and 3 were considered on the basis of annual costs to supply anticipated water demand in Area A through year 2030. Costs also are compared on a cost-per-1000 gallons of water produced. This cost includes operation and maintenance (O&M) costs for surface water and groundwater and includes only the cost of water production. Maintenance costs associated with distribution were assumed to be constant. O&M costs for groundwater production were obtained from review of records for major developments in Harris County. Billing rates for many of the water supply entities also were compared to see if the O&M costs could be considered reasonable. O&M costs for surface water were obtained by comparing City of Houston and Gulf Coast Water Authority expenses and adjusting for plant size. (See Table VI-1.)

In developing costs, the following assumptions were made:

- Capital return would be over 20 years at 8 percent interest
- Current groundwater production facilities were still usable
- Water production outside Area A will continue to be on groundwater
- Some costs associated with subsidence and groundwater withdrawal are not readily quantifiable

COMPARISON OF WATER SUPPLY: ANNUAL COSTS

As a comparison, the annual costs for water supply in year 2030 are presented in Table VI-2 under the assumption of no conversion and individual control, Alternative I; regionalization of groundwater usage, Alternative 2; and partial conversion, Alternative III.

TABLE VI - 1

WATER PRODUCTION COSTS ($/1000 GAL)

	GROUNDWATER	SURFACE WATER
CAPITAL COSTS	$0.300*	$0.510
O&M COSTS	$0.340	$0.660
WELL REHAB (Replacement)	$0.025	$0.000
TOTAL	$0.665	$1.170

* Capital costs for groundwater include costs of wells, chlorination facilities, and storage.

TABLE VI - 2
ANNUAL COST COMPARISONS (YR 2030)

	ALTERNATIVE I		ALTERNATIVE II		ALTERNATIVE III	
	Amount (MGD)	Cost ($)	Amount (MGD)	Cost ($)	Amount (MGD)	Cost ($)
GROUNDWATER PRODUCTION (.665/1000 gal)	111.7	$27,112,000	111.7	$27,112,000	71.7	$17,403,000
SURFACE WATER PRODUCTION (1.17/1000 gal)	0	0	0	0	40.0	$17,082,000
OTHER FACTORS					Reduced by percentage of surface water use versus	
Levee Upgrade Capital Costs		$ 284,000		$ 284,000	total use	$182,000
Increased Well Workover Costs		$1,182,000		$1,182,000*	Same as above	$759,000
AVERAGE ANNUAL FLOOD DAMAGE INCREASE		$2,400,000		$2,400,000*	Same as above	$1,540,000
HIGHER COSTS OF WATER PRODUCTION (greater lift)		$1,469,000		$1,469,000*	Same as above	$943,000
DISTRIBUTION LOOPS ANNUAL COST				$1,039,000**		
					With above Reductions	$37,909,000
TOTALS		$32,447,000		$33,486,000	Without Reductions	$39,820,000

* REGIONALIZATION OF GROUNDWATER COULD HAVE SOME BENEFICIAL EFFECT ON THESE TOTALS

** THERE WOULD BE SOME INTERIM SAVINGS FROM NOT HAVING WELLS ON LINE BEFORE THEY WERE ACTUALLY NEEDED. THESE SAVINGS WOULD HAVE BEEN REALIZED IN PRIOR YEARS.

SECTION VII - WATER SUPPLY MANAGEMENT AUTHORITY

The public water supply industry in Fort Bend County is characterized by more than 70 operating entities, the smallest of which serves less than 10 connections and the largest of which serves just over 20,000 connections. Thirty-nine of these operating entities serve populations of less than 1001 persons; twenty-eight systems serve populations between 1,001 and 10,000; and five systems serve populations between 10,001 and 75,000. The analysis of the water needs in Fort Bend County has demonstrated that if Fort Bend County's water needs are considered independently of the water needs in adjacent counties or the City of Houston, economics alone cannot justify the need to convert from groundwater to surface water supply. The costs for conversion to surface water are greater than the identifiable costs for continued use of groundwater and the associated damages. At the same time, however, there are a sufficient number of areas of concern, particularly relating to water quality, federal and state regulations, and unidentifiable costs that justify continued monitoring of water supplies in Fort Bend County. This section of the report discusses the limitations of the current system of management of water facilities to address future issues and how a more regional approach to management might be considered

THE CURRENT SYSTEM OF MANAGEMENT

Taking no action to coordinate the management of water resources in Fort Bend County will result in a continuation of the current development and resource utilization policies. Each incorporated city, special district, or water supply corporation will operate and maintain its water supply, treatment, and distribution system within its individual jurisdiction. This option will maintain the pattern of development occurring with individual systems, and eventually will also result in individual communities trying to solve regional problems on a local basis.

Several studies have already been performed to convert localized areas to surface water. These studies, referenced in the Phase 1 Report, include the City of Sugar Land and WCID #2, the City of Missouri City, and the Rosenburg/Richmond area. All of these studies concluded that the cost of water produced will be substantially increased within the localized service area if conversion from groundwater to surface water is implemented. None of these plans has been implemented to date.

The advantages of a decision to remain with the current system of water management are:

(1) local entities maintain control of their sources of supply

(2) water rates are established on the basis of need within the customer base of the local entity

(3) water rates in existing developments, where no new capital improvements are required, are lower (until such time as improvements are required)

The disadvantages of maintaining the current system of management are:

(1) the individual entities are limited in their ability to plan beyond their jurisdictional limits, thereby limiting the opportunity for long range future planning for water supply.

(2) each public drinking water supply would only be as reliable as the sources of water it could afford, and there would be no concentrated effort toward interconnection and increased reliability;

(3) each individual water supply entity will experience higher operating costs attempting to meet increasingly stringent water quality requirements and increasingly complex federal and state rules on their own.

(4) the competition for qualified operators will increase

(5) at such time as conversion to surface water becomes a necessity, the unit cost for the individual entities to construct and operate a surface water treament plant will be higher than if a single plant was constructed to serve a larger area.

(6) capital improvements financed through bonds will continue to add to the individual community indebtedness.

ALTERNATIVES FOR REGIONAL MANAGEMENT

In addition to the disadvantages associated with the current system of management, this study has also indicated that certain inefficiencies exist in the industry, and that specific costs associated with water production, flooding, and faulting will continue to increase. The current multitude of operating entities and lack of any central control or coordination of the expansion of water supply facilities suggest that some benefit could be gained by the installation of a regional water supply management authority. There are also possible disadvantages associated with a regional authority, depending on how the regional authority is structured with respect to the existing entities.

For this analysis, a water management authority was defined as one empowered to perform one or moreof the following functions:

1. Manage short term water needs;
2. Plan for long term water supply needs;
3. Serve as a focal point for determining the options available to meet long term needs;

4. Work within the framework of plans developed by the Fort Bend Subsidence District to minimize subsidence effects from groundwater withdrawal;
5. Perform further investigations into alternate sources of water supply available to Fort Bend County;
6. Interface with state regulatory agencies and other regional planning entities with respect to proposed rules affecting water supply.

The water management authority, whether it be the current structure of smaller independent authorities or a new regional authority, must be provided with the necessary power to manage a wide range of facilities effectively, economically, and efficiently. To accomplish this, the authority must be empowered to perform one or more of the following functions:

1. Establish rates for wholesale water service based on the cost of services provided;
2. Sell revenue bonds for water production facilities as needed to meet increasing demands;
3. Condemn property for inclusion into least-cost service alternatives;
4. Purchase existing wells from municipalities, water districts, and other public water systems to integrate those facilities into regional plans as established;
5. Operate water system facilities for existing entities under contract; and
6. Coordinate new well locations within the requirements and guidelines developed by the Fort Bend Subsidence District.

Many subdivisions of the State, including cities and Municipal Utility Districts, have powers within their area of jurisdiction, that parallel those as described.

A regional management authority for water supply in Fort Bend County could take a number of different forms. Three options considered include the following:

Option 1

One option would be to create the authority with the requisite powers and representation from the water supply entities in Fort Bend County. However, based on the results of this study which shows no immediate need to convert to surface water, the initial charge to the authority would be to

continue to monitor water supply conditions rather than to proceed with immediate regionalization of facilities. Instead of relying on the direct sales of water from the regionalized facilities, a small surcharge could be imposed on the water sales of the member entities to provide funds to continue the necessary studies and evaluations of water supply needs for the area.

Option 2

A second alternative for the control of the available supply is for the authority to contract with the individual entities for their surplus supplies on an as needed basis. The authority would purchase the water it needs from areas where there is sufficient excess capacity and sell the water to areas where demand exceeds supply. The authority would also install new wells in areas where there is insufficient capacity to serve their needs.

Option 3

Control of production facilities might be established in the legislative action, with the authority directed to purchase all public drinking water supply wells. The authority would then create a reimbursement schedule detailing the cost evaluation for each well based on age, capacity, condition, location, etc. No new wells could be drilled without the prior knowledge and consent of the authority as to size, location, and other pertinent factors. Through this action cities would yield control of their wells to the authority, and the authority would then sell bonds to finance the necessary transmission lines for distributing the available water. The sale of bonds would also provide the necessary money to purchase the existing wells.

Regional water supply management in Fort Bend County can therefore take several alternative configurations to meet the definitions discussed above. This analysis has considered the advantages and disadvantages of the following:

- Enabling an existing authority to have jurisdiction in the Fort Bend region
- Instituting a new regional authority

EXTENDING THE JURISDICTION OF AN EXISTING AUTHORITY

Three existing authorities have specific powers that ennable them to perform at least some of the stated functions of a regional authority in Fort Bend County. These include the Gulf Coast Water Authority, the Brazos River Authority, and the Fort Bend Subsidence District. All of these entities are currently in place and operational, and all are currently involved in water supply management activities as a major portion of their individual responsibilities.

The Gulf Coast Water Authority (GCWA) currently functions as a wholesale potable water supplier to many of the public and private entities in Galveston County. The water supplied by GWCA originates from the Brazos River and is treated at a water plant operated by the GWCA. The GWCA has additional water rights in the Brazos River and owns the canal system throughout Fort Bend County.

The Gulf Coast Water Authority, whose name was changed from Galveston County Water Authority on June 16, 1991, is a governmental agency of the State of Texas created pursuant to Article XVI, Section 59 of the Texas Constitution, by an act of the 59th Texas Legislature, 1965. Management and control of the Authority is vested in a board of seven directors who are appointed by the Commissioners Court of Galveston County. Three of the directors must be registered professional engineers under the laws of the State of Texas. Three of the seven directors are appointed upon the recommendation of the City Council of the City of Galveston, and one on the recommendation of the City Council of the City of Texas City. The Authority has no power to levy taxes but is authorized to issue its revenue bonds to provide funds for any and all purposes set forth in the statute creating the Authority.

The Authority was created by the legislature to provide an adequate water supply for municipal, domestic, manufacturing, irrigation, and other useful purposes for the inhabitants of Galveston County. The Authority is specifically authorized to store, transport, treat and purify, distribute, sell, and deliver water, both surface and underground, to persons, corporations, both public and private, political subdivisions of the State and others, and to purchase, construct or lease all property, works and facilities, both within and without the Authority, necessary or useful to such purpose. The Authority is expressly authorized to acquire water supplies from sources within and without the Authority, to sell, transport and deliver water to customers situated within or without the Authority, to acquire all properties and facilities necessary and useful for such purposes, and to enter into contracts for such purposes as the Board of Directors may deem desireable, for periods not exceeding 40 years.

Pursuant to the transaction with the Brazos River Authority, described under "The Mainland Project - Sources of Water Supply for the Mainland Project", the Authority is also obligated to serve existing and potential customers in Brazoria County and Fort Bend County, Texas.

The Brazos River Authority (BRA) is a State agency authorized to develop and manage the water resources of the Brazos River basin and make them available to the people of Texas. Within the Brazos River Basin, the BRA owns, operates and maintains water storage reservoirs, water treatment plants and water transmission lines, and wastewater collection systems and treatment plants on a regional basis. The BRA represents an independent management agency that could apply its expertise in Fort Bend County.

Although the BRA has historically supplied raw and treated surface water to customers, the agency is empowered to manage all water resources within the basin, including both groundwater and surface water and does do upon request by the local entities. The arrangements with the local entities vary depending upon the request and the BRA can serve as a bulk wholesaler of water or actually operate a water distribution system.

The Fort Bend Subsidence District (FBSD) is a governmental agency of the State of Texas created by the legislature to provide for the regulation of the withdrawal of groundwater within the geographic limits of Fort Bend County. Regulation of the withdrawal is for the puprose of preventing subsidence that contributes to flooding.

The FBSD is governed by a board of 13 directors, including one director appointed by the mayor of the cities of Houston, Missouri City, Sugarland, Stafford, Rosenburg, and Richmond. One director is appointed by the mayors of the remaining cities in Fort Bend County and the Commissioners Court appoints six directors, two of whom represent agricultural interests, two of whom represent industrial interests, and two of whom represent business interests.

The FBSD is empowered to administer rules and regulations that govern the withdrawal of groundwater. In establishing these rules, the Disstrict must consider the availability of surface water, the economic impact on the inhabitants of the County, the effect that subsidence has on the land, and the differing geophysical characteristics of the land. The board is charged with formulating a plan to control and mitigate subsidence within the District by regulating groundwater withdrawal. The District has implemented a permitting program for all wells greater than 5 inches in diameter, regardless of purpose. However, the FBSD is not currently empowered to own or operate a water system.

Any of the municipalities or Special Districts empowered to construct and operate a water system could also serve as a wholesaler of water to parties outside of its political jurisdiction. In doing so, they could presume the role of a regional management entity. However, most cities and districts are limited in their taxing authority and it is unlikely that they could obtain the type of funding or incur the amount of bonded indebtedness to construct the necessary regional facilities. The one municipality in Fort Bend County which is capable of assuming this role is the City of Houston. The City of Houston currently provides a substantial amount of treated surface water to users outside of the city limits to the southeast and south of Houston. One of the surface water treatment plants in which the City of Houston is the primary owner has a number of other entities with contracted shares in the plant. Although the City of Houston has indicated that they do not have the capability of supplying all of the needs of eastern Fort Bend County at the present time,

they are currently moving treated surface water to western Harris County and the portions of eastern Fort Bend County that are in the Houston City Limits.

The advantages of this alternative include:

(1) a regional management agency offers the ability to make long range plans for water development

(2) long term cost savings in water supply would result from economies of scale in treatment plant construction and operation

(3) previous management experience could bring immediate efficiency to the management agency

(4) familiarity with the Brazos River water, the Houston Metropolitan area, and Fort Bend County, should result in a management plan palatable to the participating cities and districts and at the same time address the appropriate issues.

The disadvantages of such a scheme would be:

(1) a new management agency would require some funding to perform its functions as finally defined. These costs would, to some extent, raise the cost of water

(2) some entitites (GCWA, BRA) are oriented towards the development of surface water. There could be a perceived bias and therefore reluctance on the part of the customer cities and districts to cooperate with the regional entity if it appears that surface water is being pursued before it is actually a necessity.

(3) The FBSD is a rulemaking body. Using the same body to serve as a management agency and a system operator could be percieved by member cities and districts as a conflict of interest.

(4) individual member cities attempting to serve as a regional management entity would also be percieved as being biased to their constituancy. In addition, the bonded indebtedness of the community may prohibit its ability to construct improvements when neeeded.

INSTITUTING A NEW MANAGEMENT AUTHORITY

A number of other water management authorities were investigated with respect to composition and powers to attempt to locate an authority which could be used as a pattern to prepare a draft organizational plan for Fort Bend County. The one organization which appears to provide a possible pattern for Fort Bend County is the North Texas Municipal Water District(NTMWD). This District is a regional supplier of wholesale water to a multi-county area in north central Texas. Each entity served by the District maintains its own storage, pumping, pressure maintenance and distribution facilities. A copy of the enabling legislation creating the District is contained in Appendix B. Water service is provided by several surface water treatment plants and a treated water distribution system. Control of the District is vested in a Board of

Directors which consists of representatives appointed by a majority vote of the governing body of each member entity. Water is provided to both member entities and non-member entities.

One primary difference between the situation in the area controlled by NTMWD and the Fort Bend County area is that the NTMWD area had no readily available sources of high quality groundwater. The need for adequate supplies of water to meet anticipated growth requirements provided the impetus for prompt regionalization. In Fort Bend County, there is a readily available supply of high-quality groundwater.

Creation of an authority organized and empowered as described above can be accomplished only by action of the Texas Legislature. Any schedule or timetable for accomplishments will necessarily depend upon the timing of the creation of the authority. However, if major elements of the regionalization plan are to be implemented on or before the year 2000, then every effort must be made to create the authority no later than the session of the state legislature which begins in January 1995.

The advantages of creating a new regional authority include:

(1) provides the means for achieving the objectives associated with long range water planning

(2) provides the opportunity to structure the authority to the desires of the member cities and districts

(3) represents an unbiased approach to regional water management

(4) offers an equitible resolution to vested interests of the member cities and districts

Disadvantages of this approach include the following

(1) time expended establishing the authority

(2) increased costs for water production in the near term

The assumptions which have been made in this study have all been aimed at determining a "worst case" subsidence condition so there would be no surprises based on changes in the policies of adjoining land areas. However, it must be reiterated here that the magnitude of groundwater usage for municipal needs is far greater in Harris County. The aquifers being used are shared by the two counties and the subsidence effects reflect the patterns of overall usage. Since the combined water usage of the most heavily populated areas in Fort Bend County is only a small percentage of the water used in Harris County, then the ability of an even smaller block of population to effect the overall subsidence levels by converting to surface water is greatly in doubt. If Harris County continues with the regulatory scheme put forward by the Harris-Galveston Coastal Subsidence District, it should provide, at least in the near term, a much greater impact on reducing future subsidence than any similar plan for reductions of ground water pumpage inplemented

in Fort Bend County. As a result, the efforts of Fort Bend County need to be closely allied to Harris County's efforts in resolving the subsidence issues, as noted in Option 1 above.

The Fort Bend Subsidence District needs to continue to work closely with the Harris-Galveston Coastal Subsidence District to ensure that actions which are taken represent the most cost-effective solutions for the entire area, and not just a small segment limited by a county boundary. In this regard, the formation of a water management authority could provide additional input to this process, and help insure that groundwater supplies are used in such a manner as to minimize subsidence effects, yet at the same time maximize the prudent long-term utilization of the available groundwater resources.

SECTION VIII - CONCLUSIONS AND RECOMMENDATIONS

The readily available low cost groundwater that Fort Bend County currently uses has been a significant benefit to the development of the county. Groundwater availability has provided abundant low cost water for growth, but it has also been a major factor in the proliferation of large numbers of small water facilities, with independent water production, storage, and pressure maintenance facilities. While other growing metropolitan areas of the state have had no choice but to regionalize in order to distribute the available supplies, the Fort Bend County area has neither a regional authority nor a plan in place, despite having a considerable amount of development ongoing. When development has already occurred without benefit of a regional plan, any regionalization will result in facilities which cannot be fully utilized in the regional plan. Conversely, a regional plan instituted after development begins will probably require additional facilities in order to implement the plan. As a result, ratepayers are required to pay for two sets of facilities.

For the reasons noted above, this study determined that the costs of providing water service would definitely increase over the amount paid currently if a regional plan were implemented in Fort Bend County. One additional reason for this is the ability of the local cities and water districts to control costs effectively within their jurisdictions through proper management and attention to providing low cost but high quality service. The fact that these entities have been successful is amply demonstrated in the fact that most water rates paid by municipal/district customers in Fort Bend County are very close to the $1.00 per 1000 gallons level. This holds true even though the cost of production alone from properly constructed public wells in Fort Bend County exceeds $.65/1000 gallons.

This study was performed to determine if the existing structure of individual wells and distribution systems should be converted to a regional system concept utilizing surface water instead of groundwater for the source of supply. The following paragraphs summarize the conclusions that were formed.

IMPACT OF REMAINING ON GROUNDWATER

A definite cost benefit will be achieved if the county remains on groundwater. All groundwater supply systems are currently in place and operating. Treatment of groundwater is minimal and results in a nominal cost. Water from underlying aquifers is of high quality. This source is a reliable source of water, especially during droughts. Detrimental impacts of remaining on groundwater include increased subsidence and possible increases in flooding, increased water well pumping and rehabilitation costs, possible increases in ground faulting and future water quality problems. The "worst case" analysis of future flood damages, if no additional conversion to surface water occurs in Fort Bend or Harris Counties, indicates

average annual annual increases of flood-related damages of $2,400,000 would occur over the study period to the year 2030.

IMPACT OF CONVERTING TO SURFACE WATER

Conversion to surface water will help to prevent the above consequences of groundwater withdrawal but will result in increased water costs for the County. A regional conversion plan has been presented to serve the northeastern area of the county. This is the area of the county most likely to experience the most severe adverse effects. Conversion to surface water may become cost effective at some time in the future. For now, it appears that the most cost-effective measure is better management in an attempt to mitigate or prevent adverse effects.

IMPACT OF REGIONALIZATION

Moving from an individual entity plan to a regional plan for the county or a portion of it could eventually result in a more efficient and economical system of water supply. Initial expenses would be inccurred to interconnect existing lines so that existing surplus capacities could be better utilized to meet the demands of future growth. By interconnecting these systems, the amount of excess capacity necessary for future demands would decrease, resulting in an overall lower interim cost. At the same time, existing systems would benefit from additional reliability as they would be able to utilize a variety of water sources as back-up supplies in the event of supply failure in any one area.

In addition to reducing surplus capacities, regionalization can have a positive impact on land subsidence and water quality issues as well. Individual systems tend to locate facilities in their area of jurisdiction, regardless of conditions currently existing there. A regionalized management approach allows a wider latitude in selection of well sites to help minimize the effects of subsidence and other locational problems.

Because population is concentrated in the northeastern quadrant of the county, any attempted regionalization of water supply should be limited to this smaller area. Population is scattered throughout the remainder of the county. Building transmission lines to serve water suppliers county-wide was not shown to be economically feasible. Therefore, the overall supply plan for Fort Bend County, if regionalization is adopted, should include Area A as the initial regional area and alternate areas of concentrated population as additional regional areas. This may result in a more efficient use of water supply for the current population distribution. However, it would not change the number and types of various facilities required to serve the population at ultimate development. The primary advantage would be in reducing the amounts of time that various facilities are either idle or considerably underused as the population to be served by that facility is developing.

This study did show that even if the identifiable damages are considered, the cost of groundwater is still cheaper than conversion to surface water, despite the use of the "worst case" assumption that conversion to surface water would not occur in either Fort Bend County or the western portion of Harris County. In fact, the western portion of Harris County is scheduled by regulation of HGCSD to convert to surface water between 1992 and 2030. This regulatory requirement, coupled with the much greater demand on the aquifer exerted by the City of Houston, should reduce significantly the potential adverse effects of continued groundwater usage by Fort Bend County. Economics alone cannot justify the conversion to surface water, but issues of water quality and associated regulations are likely to provide justification in the future.

What the study has demonstrated, however, is the continued need for the Fort Bend Subsidence District to interact with the HGCSD, and to play a role in planning for future water supplies in Fort Bend County. While the costs of providing a regional authority and the costs of converting to surface water have been well researched here, there are a number of areas of potential increased costs from continued reliance on groundwater that are not well quantified. These costs include increased flood damages from land subsidence (which were estimated in this study), as well as the costs for reduced property values, decreased tax revenues associated with property value declines, damages caused by ground fault activation, higher costs of water production and treatment associated with lowering water levels, and potential water quality deterioration. These latter costs were not quantifiable with the information available at present. The Fort Bend Subsidence District could play a valuable role by continuing to gather information about these costs and by adding them to the estimates already developed. At the same time, the Subsidence District could monitor possible changes which could influence other portions of the cost estimates developed. Alternatively, some other managerial entity could be established to assume the current duties of the Subsidence District as well as the duties outlined above.

RECOMMENDATIONS

The following are specific recommendations based on the results of the Phase 1 and Phase 2 Studies:

(1) The production and use of groundwater in Fort Bend County and in adjoining areas of Harris County, and the resulting subsidence that occurs, should be monitored at regular intervals. This would allow the assumptions regarding future groundwater usage and the resulting subsidence to be evaluated as time passes. Significant changes in groundwater usage and subsidence could alter the major conclusions of this study and could hasten the time when major conversion to surface water would be necessary.

(2) Further refinement of the flood damage estimates and a more detailed evaluation of the costs associated with faulting, increased water production costs and potential water quality problems from increased groundwater production and resulting water level declines is recommended.

(3) Continual monitoring of the potential sources of available raw surface water should be undertaken in the County to insure that future surface water supplies will be available if needed.

(4) Consideration should be given to the creation of a regional water authority to ultimately provide for a regional plan for the optimum use of both the groundwater and surface water resources needed for continued development in the County. Initially the authority should be empowered to undertake the planning and monitoring functions described in items (1) through (3) above. Ultimately, consideration should be given to empowering the authority to own and operate a regional water supply system in the County.

(5) The Fort Bend Subsidence District should continue to function as a regulatory agency and should develop a plan to control subsidence and conserve the ground water resources in the County.

APPENDIX A - FORT BEND COUNTY UTILITY DISTRICTS

ID NUMBERS ON EXHIBIT III-3	UTILITY DISTRICT
1	Bellfort Mud
2	FBC MUD 67
3	FBC MUD 69
4	FBC MUD 71
5	FBC MUD 77
6	FBC MUD 5
7	FBC MUD 73
8	FBC MUD 51
9	FBC MUD 25
10	FBC MUD 52
11	FBC MUD 74
12	H-FBC MUD 3
13	H-FBC MUD 4
14	Willow Point
15	H-FBC MUD 1
16	FBC MUD 37
17	H-FBC MUD 5
18	Cornerstones MUD
19	Cinco MUD 9
20	FBC MUD 53
21	Cinco MUD 10
22	FBC MUD 37
23	Cinco MUD 2
24	Cinco MUD 6
25	Cinco MUD 3
26	Cinco MUD 12
27	Cinco MUD 11
28	FBC MUD 58
29	Cinco MUD 5
30	FBC MUD 70

31	Cinco MUD 1
32	Cinco MUD 14
33	FBC MUD 57
34	Cinco MUD 13
35	Cinco MUD 4
36	Via Ranch MUD 2
37	Cinco MUD 7
38	FBC MUD 35
39	Via Ranch MUD 4
40	Via Ranch MUD 2
41	FBC MUD 99
42	Via Ranch MUD 1
43	Cinco MUD 8
44	Via Ranch MUD 3
45	FBC MUD 34
46	Chelford City MUD
47	FBC MUD 44
48	Big Oaks MUD
49	FBC MUD 93
50	Mission Bend MUD 1
51	Cinco MUD 8
52	Grand Mission MUD 1
53	FBC LID 12
54	FBC MUD 105
55	FBC MUD 91
56	FBC LID 12
57	FBC MUD 30
58	FBC LID 12
59	FBC MUD 50
60	North Mission Glen MUD
61	Kingsbridge MUD
62	Renn Road MUD
63	South Mission Glen MUD
64	FBC MUD 81
65	FBC MUD 2
66	Twinwood MUD

67	FBC WCID 1
68	FBC WCID 1
69	Eldridge Road MUD
70	Meadows MUD
71	Eldridge Road MUD
72	FBC WCID 1
73	Burney Road MUD
74	FBC MUD 21
75	Eldridge Road MUD
76	Burney Road MUD
77	FBC MUD 41
78	FBC WCID 2
79	Pecan Grove MUD 1
80	FBC MUD 28
81	City of Cities MUD
82	FBC LID 3
83	FBC MUD 27
84	First Colony MUD 7
85	FBC MUD 20
86	FBC MUD 9
87	Blue Ridge West MUD
90	First Colony MUD 9
91	FBC MUD 16
92	First Colony MUD 8
93	FBC MUD 26
94	FBC MUD 42
95	First Colony MUD 2
96	FBC MUD 68
97	FBC MUD 13
98	FBC MUD 12
99	Post Oak Road MUD
100	FBC MUD 36
101	First Colony MUD 6
102	Meadowcreek MUD
103	FBC MUD 23
104	First Colony MUD 1

105	Quail Valley MUD
106	First Colony MUD 5
108	First Colony MUD 4
109	First Colony MUD 4
110	Thunderbird ID
111	FBC MUD 19
112	FBC MUD 104
113	FBC MUD 1
114	FBC MUD 45
115	FBC MUD 103
116	First Colony MUD 3
117	FBC MUD 106
118	FBC MUD 101
119	FBC MUD 107
120	FBC MUD 108
121	FBC MUD 102
122	FBC MUD 109
123	FBC MUD 94
124	FBC MUD 31
125	Plantation MUD
126	FBC MUD 23
127	FBC MUD 56
128	FBC MUD 55
130	FBC MUD 66
131	FBC MUD 59
132	FBC MUD 54
133	FBC MUD 65
134	FBC MUD 63
135	Sienna Plantation LID
136	FBC MUD 79
137	Sienna Plantation MUD
138	Sienna Plantation FWSD
139	FBC MUD 45
140	Palmer Plantation MUD 1
141	Palmer Plantation MUD 2
142	FBC MUD 24

143	FBC MUD 47
144	FBC MUD 45
145	FBC MUD 49
146	FBC MUD 48
147	FBC MUD 60

STATE ACT CREATING

NORTH TEXAS MUNICIPAL WATER DISTRICT

Original Act of 52nd Legislature (Regular Session 1951) as codified in Article 8280 141 Vernon's Texas Civil Statutes.

Also includes amendments:

1967 - Section 1a
Section 3b
Section 7a,b,c,d,e
Section 8b

1973 - Section 27

Section 1. By virtue of Article XVI, Section 59 of the Texas Constitution, there is hereby created a conservation and reclamation district to be known as "North Texas Municipal Water District", (hereinafter called "District") which shall be a governmental agency and a body politic and corporate.

Section 1a. In this Act, unless the context requires a different definition:

(1) "District" means the North Texas Municipal Water District, and any other public body at any time succeeding to the property and principal rights, powers, and obligations of said North Texas Municipal Water District.

(2) "Member Cities" means the cities of Garland, Princeton, Plano, Mesquite, Wylie, Rockwall, Farmersville, McKinney, Forney, and Royse City and any other city which may hereafter legally become a part of said District.

(3) "Customer" means users of District water other than member cities.

(4) "Prospective customer" means any person, firm, corporation, company, partnership, association, body corporate, or politic who evidences in any manner an interest in securing water from District.

(5) "Basic service area" means that geographic area contained within the corporate limits of the member cities, and such areas as are now or may hereafter be served by said member cities' primary water system.

(6) "Service area" means that geographic area contained within the watershed of the East Fork of the Trinity River, Texas, and in addition thereto, any area contained within the corporate limits of the member cities and such areas as are served by said member cities' water system.

(7) "Other service area" means that geographic area contained within the State of Texas and being outside the "service area" as defined in Subdivision (6) of this section.

(8) "Original Lavon water" means that water for which the District holds a permit from Texas Water Rights Commission to store and divert from Lavon Reservoir on the East Fork of the Trinity River, Texas, as originally constructed.

(9) "Enlarged Lavon water" means that water which the District holds now, or secures in the future, under or through a permit from the Texas Water Rights Commission to store and divert from Lavon Reservoir on the East Fork of the Trinity River, Texas, as modified.

(10) "Other water" means any water which the District secures under or through a permit from the Texas Water Rights Commission to store and divert, other than Lavon water, or enlarged Lavon water.

(11) "Interim basis" means only until such time as the District needs such water for the use and benefit of its service area - not permanent, but only during such times as a surplus of dependable safe yield is present in each classification of water.

(12) "Primary right" means the superior right to permanent water, and to the quantity, quality, and price of the water.

Section 2. The District shall comprise all of the territory which was contained within the cities of Garland, Princeton, Plano, Mesquite, Wylie, Rockwall, Farmersville, McKinney, Forney, and Royse City on March 1, 1951; provided, however, that no defect in the definition of the boundaries of any of said cities or in any past or future proceedings for the annexation of territory to any of said cities shall affect the validity of the District hereby created or any of its powers or duties. It is hereby found that all of the land thus included in said District will be benefited by the improvements to be acquired and constructed by said District.

Section 3 (a). All powers of the District shall be exercised by a board of directors. Such directors shall be appointed by majority vote for the governing body of each of the cities contained in the District. In appointing the first directors for a city containing 5,000 population or more according to the most recent Federal Census, the governing body of such city shall appoint one director who shall serve to and including May 31, 1952, and one who shall serve to and including May 31, 1953. In May, 1952 and in May of each year thereafter, the governing body of such city shall appoint one director for the two year term beginning on June 1 of that year. In appointing the first director for a city of less than 5,000 population, according to the most recent Federal Census, the governing body of such city shall appoint one director who shall

serve to and including May 31, 1952. In May, 1952, and in May of each even year thereafter, the governing body shall appoint one director for the two year term beginning on June 1 of that year. Each director shall serve for his term of office as herein provided, and thereafter until his successor shall be appointed and qualified. No person shall be appointed a director unless he resides in and owns taxable property in the city from which he is appointed. No member of a governing body of a city, and no employee of a city, shall be appointed as director. Such directors shall subscribe to the Constitutional oath of office, and each shall give bond for the faithful performance of his duties in the amount of $5,000.00, the cost of which shall be paid by the District. A majority shall constitute a quorum.

b. Each director shall receive a fee of $50 for attending each meeting of the board and $20 per day devoted to the business of the District other than attending board meetings, but not more than $1,200 shall be paid to any director in one calendar year therefor. Each director shall be entitled to reimbursement for actual expenses incurred in attending to District business provided the service and expense are expressly approved by the Board.

Section 4. The board of directors shall elect from its number a president and a vice-president of the District, and such other officers as in the judgment of the board are necessary. The president shall be the chief executive officer of the District and the presiding officer of the board, and shall have the same right to vote as any other director. The vice-president shall perform all duties and exercise all powers conferred by this Act upon the president when the president is absent or fails or declines to act. The board shall also appoint a secretary and a treasurer who may or may not be members of the board, and it may combine those offices. The treasurer shall give bond in such amount as may be required by the board of directors, but in no event less than $100,000.00. The condition of such bond shall be that he will faithfully account for all money which shall come into his custody as treasurer of the District. The board shall appoint all necessary engineers, attorneys and other employees. The board shall adopt a seal for the District.

Section 5. Other territory may be annexed to the District in the following manner:

(a) A petition praying for such annexation signed by fifty, or a majority of the qualified voters of the territory who own taxable property therein, and who have duly rendered the same to the city (if situated within

a city or town) or county for taxation shall be filed with the board of directors of the District. The petition shall describe the territory by metes and bounds or otherwise unless such territory is the same as that contained in a city or town, in which event it shall be sufficient to state that the territory to be annexed is that which is contained within such city or town.

(b) If the board of directors finds that the petition complies with, and is signed by the number of qualified persons required by the foregoing subsection, that the annexation would be to the interest of the territory and the District, and that the District will be able to supply water to the territory, it shall adopt a resolution stating the condition, if any, under which such territory may be annexed to the District, and requesting the Board of Water Engineers of the State of Texas (or any board or body succeeding substantially to the powers and duties of said Board of Water Engineers) hereinafter called "State Board", to annex said territory to the District. A certified copy of such resolution and of the petition shall be filed with the State Board.

(c) The State Board shall adopt a resolution declaring its intention to call an election in the territory for the purpose of submitting the proposition of whether or not such territory shall be annexed to the District, and fix a time and place when and where a hearing shall be held by the State Board on the question of whether the territory will be benefited by the improvements, works, and facilities then owned or operated or contemplated to be owned or operated by the District. Railroad right-of-way, transmission lines and other property of electric and gas utilities which are not situated within the defined limits of an incorporated city or town will not be benefited by improvements, works and facilities which the District is authorized to construct; therefore it is provided that no railroad right-of-way or transmission lines and other property of electric and gas utilities shall hereafter be annexed to the District except such right-of-way and transmission lines and other property of electric and gas utilities as are contained within the limits of an incorporated city or town then or theretofore annexed to the District.

(d) Notice of the adoption of such resolution stating the time and place of such hearing, addressed to the citizens and owners of property in such territory shall be published one time in a newspaper designated by the State Board at least ten days prior to the date of such hearing. The notice shall describe the territory in the same manner as required or permitted by the petition.

(e) All persons interested may appear at such hearing and offer evidence for or against the intended annexation. Such hearing may proceed in such order and under such rules as may be prescribed by the State Board, and the hearing may be recessed from time to time. If, at the conclusion of the hearing, the State Board finds that all of the lands in such territory will be benefited by the present or contemplated improvements, works or facilities of the District, the State Board shall adopt a resolution calling election in the territory to be annexed, stating therein the date of the election, the place or places of holding the same, and appointing a presiding judge for each voting place who shall appoint the necessary assistant judges and clerks to assist in holding the election.

(f) Notice of such election, stating the date thereof, the proposition to be voted upon and the conditions under which the territory may be annexed, or making reference to the resolution of the board of directors for that purpose, and the place or places of holding the same, shall be published one time in a newspaper designated by the State Board at least ten days before the day set for the election.

(g) Only qualified electors who reside in, and who own taxable property in such territory and who have duly rendered the same to the city (if situated within a city or town) or county in which it is situated for taxation shall be qualified to vote in said election. Returns of said election shall be made to the State Board.

(h) The State Board shall canvass the returns of the election and adopt a resolution declaring the results thereof. If such resolution shows that a majority of the votes cast are in favor of annexation the State Board shall enter an order annexing said territory to the District, and such annexation shall thereafter be incontestable except in the manner and within the time for contesting elections under the general election law. A certified copy of said order shall be recorded in the deed records of the county in which the territory is situated.

(i) The State Board, in calling the election on the proposition for annexation of territory, may include as a part of the same proposition a proposition for the assumption of its part of the tax supported bonds of the District then outstanding, and those theretofore voted but not yet sold, and for the levy of an ad valorem tax on taxable property in said territory along with the tax in the rest of the District for the payment thereof.

(j) After territory is added to the District, the board of directors of the District may call an election over the entire District for the purpose of determining whether the entire District as enlarged shall assume the tax supported bonds then outstanding and those theretofore voted but not yet sold and whether an ad valorem tax shall be levied upon all taxable property within the District as enlarged for the payment thereof, unless such proposition is voted along with the annexation election and becomes lawfully binding upon the territory annexed. Such election shall be called and held in the same manner as elections for the issuance of bonds as provided in this Act.

(k) If no newspaper is published in territory to be annexed, the notices shall be posted in three public places therein.

Section 6. When any city, the territory of which is hereafter annexed to the District, contains 5,000 inhabitants or more according to the most recent Federal Census, the governing body of the city shall appoint one director for the term ending the following May 31, and one director for the term ending one year after the following May 31, and in May of each year shall appoint one director for a two year term the same as provided in this Act for cities originally included in the District. If such city contains less than 5,000 inhabitants according to the most recent Federal Census, the governing body of the city shall appoint one director whose term shall expire the following May 31, and in May of each second year thereafter shall appoint one director for a two year term. Whenever such city may later attain a population of 5,000 or more according to the Federal Census, it shall thereafter be entitled to two directors to be appointed as herein provided.

Section 7 (a). The District is hereby empowered to acquire any and all rights in and to storage and storage capacity in the Lavon Reservoir as now constructed, or later modified, and in any other reservoir or from any other source, and the right to take water from such reservoirs or other sources after obtaining a permit from the Water Rights Commission of the State of Texas, and by complying with Chapter 1, Title 128, Revised Civil Statutes of Texas, 1925, as amended, and pursuant to any contract or contracts which the District may make with the United States Government, any of its agencies, or any other agency, in reference to such rights, and to develop or otherwise acquire, with consent of owners of surface, underground sources

of water. The District is also empowered to construct or otherwise acquire all works, plants and other facilities necessary or useful for the purpose of storing, impounding, retaining, diverting, or processing this water and transporting it to cities and other areas for municipal, domestic and industrial purposes. To the extent permissible under the contract with the United States Government, any of its agencies, and any other agency, the District may dispose of surplus water under its control by contract with the Texas Water Development Board or any other State or local agency for irrigation or beneficial purposes. No works for the diversion of such water from the impounding dams shall be constructed until the plans are approved by the Water Rights Commission of the State of Texas; provided that the District shall apply to and obtain authority from the Water Rights Commission of the State of Texas to appropriate such waters.

(b) The District may not be compelled to supply water for use outside its service area except by order of the Texas Water Rights Commission in accordance with Article 7560, et. seq., Revised Civil Statutes of Texas, 1925.

(c) The basic service area has the primary right to water in each classification which the District secures under permit from the Texas Water Rights Commission.

(d) This Act does not compel any customer or prospective customer to secure water from the District, except pursuant to contracts voluntarily executed.

(e) This Act does not alter any outstanding permit, contract or other obligation.

Section 8. For the purpose of carrying out any power or authority conferred by this Act the District shall have the right to acquire land and easements within and without the District (including land above the probable high water line around any such reservoirs) by condemnation in the manner provided by Title 52, Revised Civil Statutes, as amended, relating to eminent domain. This District is hereby declared to be a municipal corporation within the meaning of Article 3268 of said Title 52. The amount of and character of interest in land and easements thus to be acquired shall be determined by the board of directors.

(b) In the event that the District, in the exercise of the power of eminent domain or police power, or any other power granted thereunder, makes necessary the relocation, raising, lowering, rerouting, or changing the grade of, or altering the construction of any railroad, electric

transmission, telegraph or telephone lines, properties and facilities, or pipeline, all such relocation, raising, lowering, rerouting, changing of grade or alteration of construction shall be accomplished at the sole expense of the District. The term "sole expense" shall mean the actual cost of such relocation, raising, lowering, rerouting, or change in grade or alteration of construction in providing comparable replacement without enhancement of such facilities, after deducting there from the net salvage value derived from the old facility.

Section 9. Any construction contract requiring an expenditure of more than $25,000.00 shall be made after publication of a notice to bidders once each week for two weeks, before awarding the contract. Such notice shall be sufficient if it states the time and place when and where the bids will be opened, the general nature of the work to be done, or the material, equipment or supplies to be purchased, and states where and the terms upon which copies of the plans and specifications may be obtained. The publication shall be in a newspaper published in the District and designated by the board of directors.

Section 10 (a). For the purpose of providing a source of water supply for cities and other users for municipal, domestic and industrial purposes, as authorized by this Act, and for the purpose of carrying out any other power or authority conferred by this Act, the District is empowered to issue its negotiable bonds to be payable from such revenues or taxes, or both revenues and taxes, of the District as are pledged by resolution of the board of directors. Pending the issuance of definitive bonds the board may authorize the delivery of negotiable interim bonds or notes, eligible for exchange or substitution by use of the definitive bonds.

(b) Such bonds shall be authorized by resolution of the board of directors and shall be issued in the name of the District, signed by the president or vice-president, attested by the secretary and have the seal of the District impressed thereon. They shall mature serially or otherwise in not to exceed forty years and may be sold at a price and under terms determined by the board of directors to be the most advantageous reasonably obtainable, provided that the interest cost to the District, calculated by use of standard bond interest tables currently in use by insurance companies and investment houses does not exceed 6% per annum, and within the discretion of the Board, may be made callable prior to maturity at such times and prices

as may be prescribed in the resolution authorizing the bonds, and may be made registerable as to principle or as to both principal and interest.

(c) Bonds may be issued in more than one series and from time to time as required for carrying out the purposes of this Act.

(d) The bonds may be secured by a pledge of all or part of the net revenues of the District, or by the net revenues of any one or more contracts theretofore or thereafter made or other revenues specified by resolution of the board of directors. Any such pledge may reserve the right, under conditions therein specified, to issue additional bonds which will be on a parity with or subordinate to the bonds then being issued. The term "net revenue" as used in this section shall mean the gross revenues of the District after deduction of the amount necessary to pay the cost of maintaining and operating the District and its properties.

(e) For the purposes stated in Section 10 (a) hereof and subject to the conditions prescribed in Section 13 (a) hereof, the District is also empowered to issue bonds payable from ad valorem taxes to be levied on all taxable property therein, or to issue bonds secured both by and payable from such taxes and the revenues of the District. Where bonds are issued wholly or partially from ad valorem taxes, it shall be the duty of the board of directors to levy a tax sufficient to pay the bonds and the interest thereon as such bonds and interest become due, but the rate of the tax for any year may be fixed after giving consideration to the money received from the pledged revenues which may be available for payment of principal and interest to the extent and in the manner permitted by the resolution authorizing the issuance of the bonds.

(f) Where bonds payable wholly from revenues are issued, it shall be the duty of the board of directors to fix, and from time to time to revise, the rates of compensation for water sold and services rendered by the District which will be sufficient to pay the expense of operating and maintaining the facilities of the District and to pay the bonds as they mature and the interest as it accrues, and to maintain the reserve and other funds as provided in the resolution authorizing the bonds. Where bonds payable partially from revenues are issued, it shall be the duty of the board to fix, and from time to time to revise, the rate of compensation for water sold and services rendered by the District which will be sufficient to assure compliance with the resolution authorizing the bonds.

(g) From the proceeds from the sale of the bonds, the District may set aside an amount for the payment of interest expected to accrue during construction and a reserve interest and sinking fund, and such provision may be made in the resolution authorizing the bonds. Proceeds from the sale of the bonds may also be used for the payment of all expenses necessarily incurred in accomplishing the purposes for which this District is created, including expenses of issuing and selling the bonds.

(h) In the event of a default or a threatened default in the payment of principal of or interest on bonds payable wholly or partially from revenues, any court of competent jurisdiction may, upon petition of the holders of 25% of the outstanding bonds of the issue thus in default or threatened with default, appoint a receiver with authority to collect and receive all income of the District except taxes, employ and discharge agents and employees of the District, take charge of funds on hand (except funds received from taxes unless commingled) and manage the proprietary affairs of the District without consent or hindrance by the directors. Such receiver may also be authorized to sell or make contracts for the sale of water or renew such contracts with the approval of the court appointing him. The court may vest the receiver with such other powers and duties as the court may find necessary for the protection of the holders of the bonds.

Section 11. The District is authorized to issue refunding bonds for the purpose of refunding any outstanding bonds authorized by this Act and interest thereon. Such refunding bonds may be issued to refund more than one series of outstanding bonds and combine the pledges for the outstanding bonds for the security of then refunding bonds, and may be secured by other or additional revenues. The provisions of this law with reference to the issuance by the District of other bonds and their approval by the Attorney General and the remedies of the holders shall be applicable to refunding bonds. Refunding bonds shall be registered by the Comptroller upon surrender and cancellation of the bonds to be refunded, but in lieu thereof, the resolution authorizing their issuance may provide that they shall be sold and the proceeds thereof deposited in the bank where the original bonds are payable, in which case the refunding bonds may be issued in an amount sufficient to pay the interest on the original bonds to their option date or maturity date, and the Comptroller shall register them without concurrent surrender and cancellation of the original bonds.

Section 12. Any bonds (including refunding bonds) authorized by this law, not payable wholly from ad valorem taxes, may be additionally secured by a trust indenture under which the trustee may be a bank having trust powers situated either within or outside of the State of Texas. Such bonds within the discretion of the board of directors may be additionally secured by a deed of trust lien upon physical properties of the District and all franchises, easements, water rights and appropriation permits, leases, and contracts and all rights appurtenant to such properties, vesting in the trustee power to sell the properties for payment of the indebtedness, power to operate the properties and all other powers and authority for the further security of the bonds. Such trust indenture regardless of the existence of the deed of trust lien may contain any provisions prescribed by the board of directors for the security of the bonds and the preservation of the trust estate, and may make provision for amendment or modification thereof and the issuance of bonds to replace lost or mutilated bonds. Any purchaser under a sale under the deed of trust lien, where one is given, shall be the owner of the properties, facilities and rights so purchased and shall have the right to maintain and operate the same.

Section 13 (a). No bonds payable wholly or partially from ad valorem taxes (except refunding bonds) shall be issued unless authorized by an election at which only the qualified voters who reside in the District and who own taxable property therein and who have duly rendered the same for taxation, shall be qualified to vote at said election, and unless a majority of the votes cast at said election is in favor of the issuance of the bonds. No election for the issuance of bonds secured either wholly or partially by a pledge of ad valorem taxes shall be ordered until the board of directors is able to and does publish, in the manner in this section prescribed, a summary of the improvements to be financed with the proceeds of bonds to be issued. If at such time the District has not provided facilities for delivering water to any city within the District, and if such summary of improvements does not include provision for delivering water to such city, the District shall cause to be published in such city notice of its intention on a date therein specified to call an election involving the issuance of bonds, wholly or partly secured by a pledge of ad valorem taxes and containing the summary of the proposed improvements. Such notice shall be published at least once in a newspaper published in or having general circulation in such city, the date of publication being at least 14 days prior to the date on which the District intends to adopt a resolution ordering

such election. The District shall also mail a copy of such notice to the Mayor of such city at least 14 days prior to the date so designated for the calling of the election, the governing body of such city, so notified, shall adopt a resolution to the effect that the District has not provided facilities for delivering water to such city and does not propose to provide the facilities necessary for such purpose with the proceeds from the proposed tax supported bonds and on a reasonable cost basis; and it is to the best interests of the people of the city that such city be eliminated from the District for all purposes; and seeking withdrawal from the District; and if prior to the date designated for such election a certified copy of such resolution is delivered to the District and to the State Board of Water Engineers at Austin, Texas, the District shall not proceed with the calling of such election until the State Board of Water Engineers shall have acted finally upon such request for withdrawal from the District. Upon receipt of the certified copy of the resolution requesting such withdrawal the Board of Water Engineers shall fix a date for a hearing on the request, giving written notice thereof both to the city and to the District. If at the hearing the Board of Water Engineers finds that no facilities have been made available to the city and that none will become available to the city because of the proposed tax-supported bond issue for the delivery of water to the city, and upon a reasonable cost basis, the board shall enter an order eliminating the city from the District. The necessity for such hearing will be avoided if the District files with the board a consent to the elimination of such territory.

But if the Board shall find either that such facilities are available or will be provided from the proceeds of the proposed bonds for the providing of such facilities upon a reasonable cost basis, it shall enter an order denying the request for withdrawal. After such order by the Board of Water Engineers shall have been entered, the District may proceed with the ordering of such election with such city either eliminated or retained in its boundaries as may have been prescribed in such order. Bonds not payable wholly or partially from ad valorem taxes may be issued without an election.

(b) Such election may be called by the board of directors without a petition. The resolution calling the election shall specify the time and places of holding the same, the purpose for which the bonds are to be issued, the maximum amount thereof, the maximum maturity thereof, the form of the ballot, and the presiding judge for each voting place.

The presiding judge serving at each voting place shall appoint one assistant judge and at least two clerks to assist in holding such election. Notice of the election shall be given by publishing a substantial copy thereof in one newspaper published in each city contained in the District for two consecutive weeks. The first publication shall be at least twenty-one days prior to the election. In any city in which no newspaper is published, notice shall be given by posting a copy of the resolution in three public places.

(c) The returns of the election shall be made to and canvassed by the board of directors of the District.

(d) The General Laws relating to elections shall be applicable to elections held under this section of this law, except as otherwise provided in this law.

Section 14. After any bonds (including refunding bonds) are authorized by the District, such bonds and the record relating to their issuance shall be submitted to the Attorney General for his examination as to the validity thereof. Where such bonds recite that they are secured by a pledge of the proceeds of a contract theretofore made between the District and any city or other governmental agency or district, a copy of such contract and the proceedings of the city or other governmental agency or District authorizing such contract shall also be submitted to the Attorney General. If such bonds have been authorized and if such contracts have been made in accordance with the Constitution and Laws of the State of Texas he shall approve the bonds and such contracts and the bonds then shall be registered by the Comptroller of Public Accounts. Thereafter the bonds, and the contracts, if any, shall be valid and binding and shall be incontestable for any cause.

Section 15. The District is authorized to enter into contracts with cities and others for supplying water to them. The District is also authorized to contract with any city for the rental or leasing of, or for the operation of the water production, water supply, water filtration or purification and water supply facilities of such city upon such consideration as the District and the city may agree. Any such contract may be upon such terms and for such time as the parties may agree, and it may provide that it shall continue in effect until bonds specified therein and refunding bonds issued in lieu of such bonds are paid.

Section 16 (a). The board of directors shall designate one or more banks within the District to serve as depository for the funds of the District. All funds of the District shall be deposited in such depository bank or banks, except that funds pledged to pay bonds may be deposited with the trustee bank named in the trust agreement, and except that funds shall be remitted to the bank of payment for the payment of principal of and interest on bonds. To the extent that funds in the depository banks and the trustee bank are not insured by the F.D.I.C. they shall be secured in the manner provided by law for the security of county funds.

(b) Before designating a depository bank or banks, the board of directors shall issue a notice stating the time and place when and where the board will meet for such purpose and inviting the banks in the District to submit applications to be designated depositories. The term of service for depositors shall be prescribed by the board. Such notice shall be published one time in a newspaper or newspapers published in the District and specified by the board.

(c) At the time mentioned in the notice, the board shall consider the applications and the management and condition of the banks filing them and shall designate as depositories the bank or banks which offer the most favorable terms and conditions for the handling of the funds of the District and which the board finds have proper management and are in condition to warrant handling of District funds. Membership on the board of directors of an officer or director of a bank shall not disqualify such bank from being designated as depository.

(d) If no applications are received by the time stated in the notice, the board shall designate some bank or banks within or without the District upon such terms and conditions as it may find advantageous to the District.

Section 17. The District is authorized to acquire water appropriation permits directly from the Board of Water Engineers of the State of Texas; or from owners of permits. The District is also authorized to purchase water or a water supply from any person, firm, corporation or public agency, or from the United States Government or any of its agencies.

Section 18. All bonds of the District shall be and are hereby declared to be legal and authorized investments for banks, savings banks, trust companies, building and loan associations, savings and loan associations, and insurance companies. Such bonds shall be eligible to secure the deposit of any and all public funds of the State of Texas, and any and all public funds of cities, towns, villages, counties, school districts, or other political corporations or subdivisions of the State of Texas; and such bonds shall be lawful and sufficient security for said deposits to the extent of their value, when accompanied by all unmatured coupons appurtenant thereto.

Section 19. The accomplishment of the purposes stated in this Act being for the benefit of the people of this State and for the improvement of their properties and industries, the District in carrying out the purposes of this Act will be performing an essential public function under the Constitution and shall not be required to pay any tax or assessment on the project or any part thereof, and the bonds issued hereunder and their transfer and the income therefrom, including the profits made on the sale thereof, shall at all times be free from taxation within this State.

Section 20 (a). The tax rolls of the cities situated within the District, and within territory hereafter annexed, are hereby adopted and shall constitute the tax rolls of the District until assessments and tax rolls shall be made by the District.

(b) Prior to the sale and delivery of District bonds which are payable wholly or partially from ad valorem taxes the board of directors shall appoint a tax assessor and collector and a board of equalization and cause taxes to be assessed, valuations to be equalized, and tax rolls to be prepared. General laws applicable to water control and improvement districts with reference to tax assessors and collectors, boards of equalization, tax rolls and the levy and collection of taxes and delinquent taxes shall be applicable to this District, except that the board of equalization to be appointed each year by the board of directors shall consist of one member residing in each city then contained in the District.

Section 21 (a). The board of directors of the District shall have the power to adopt and promulgate all reasonable regulations to secure, maintain and preserve the sanitary condition of all water in and to flow into any reservoir owned by the District, or which by contract or otherwise it may control, to prevent waste of water or the unauthorized use thereof, to regulate residence, hunting, fishing, boating, and camping, and all recreational and business privileges, along or around any such reservoir or any body of land, or easement owned or controlled by the District.

(b) Such District may prescribe reasonable penalties for the breach of any regulation of the District, which penalties shall not exceed fines of more than $200.00, or imprisonment for not more than thirty days, or may provide both such fine and such imprisonment. The penalties hereby authorized shall be in addition to any other penalties provided by the laws of Texas and may be enforced by complaints filed in the appropriate court of jurisdiction; provided, however, that no rule or regulation which provides a penalty for the violation thereof shall be in effect, as to enforcement of the penalty, until five days next after the District may have caused a substantive statement of the particular rule or regulation and the penalty for the violation thereof to be published, once a week for two consecutive weeks, in the county in which said reservoir is situated; or in any county in which it is partly situated. The substantive statement so to be published shall be as condensed as is possible to afford an intelligent direction of the mind to the act forbidden by the rule or regulation; one notice may embrace any number of regulations; there must be embraced in the notice advice that breach of the particular regulation, or regulations, will subject the violator to the infliction of a penalty; and there also shall be included in the notice advice that the full text of the regulations sought to be enforced is on file in the principal office of the District, where the same may be read by any interested person. Five days after the second publication of the notice hereby required, the advertised regulation shall be in effect, and ignorance of any such regulation shall not constitute a defense to a prosecution for the enforcement of a penalty; and the rules and regulations authorized hereby, after the required publication, shall judicially be known to the courts and shall be considered of a nature like unto that of valid penal ordinance of a city of the State.

(c) It further is expressly provided the District shall have the power to employ and constitute its own peace officers, and any such officer or any county peace officer shall have the power to make arrests when necessary to prevent or abate the commission of and offense against the regulations of the District, and against the laws of the State of Texas, when any such offense or threatened offense occurs upon any land, water, or easement owned or controlled by the District; or to make such arrest at any place, in case of an offense involving injury or detriment to any property owned or controlled by such District.

Section 22. The District is authorized to establish or otherwise provide for public parks and recreation facilities, and to acquire land adjacent to any reservoir in which said District owns water storage rights for such purposes; provided, however, that no money received from taxation or from bonds payable wholly or partially from taxation shall be used for such purpose.

Section 23. It is provided, however, that the District shall not exercise any of the power or authority conferred by this Act unless and until the establishment of this District is confirmed at an election held throughout the District. After the passage of this Act the Board of Water Engineers of the State of Texas shall order separate elections to be held in each of the cities contained in the District, at which elections there shall be submitted the question of whether or not the establishment of this District shall be confirmed. Notice of said election shall be published in a newspaper published in each of the cities once each week for two weeks; the first notice shall be at least fourteen days prior to the date set for the election. The Board of Water Engineers shall appoint a presiding judge for each of the voting places and each of the presiding judges shall appoint at least two judges and two clerks to assist him in holding the election. Only qualified voters who reside in the District and who own taxable property therein and who have duly rendered the same for taxation shall be qualified to vote at said election. If a majority of the votes cast at the election held separately in each city is in favor of confirmation, the Board of Water Engineers shall so declare, and thereafter the District shall have all of the powers and authority conferred by this Act. It is provided, however, that the proposition to be submitted at such election shall specify that the District shall be confirmed to include each city in which the majority vote favors confirmation and the District shall contain only those cities in which the majority vote favored confirmation the same as though the other cities had not been included in this Act.

Section 24. If any provision of this Act or the application thereof to any person or circumstance shall be held to be invalid or unconstitutional, the remainder of the Act, and the application of such provision to other persons or circumstances, shall not be affected thereby.

Section 25. It is hereby found that notice of intention to apply for the passage of this Act has been published in the locality where the matter and things to be affected hereby are situated, which notice stated the substance of this law, and was published at least thirty days prior to the introduction into the Legislature of this bill, and in the manner provided by law, and the time, form and manner of giving said notice is hereby approved and ratified. The evidence of the foregoing was exhibited in the Legislature before the passage of this Act. Acts 1951, 52nd Legislature, p. 96, ch. 62.

Section 26. NO SECTION 26.

Section 27 (a). In addition to all other powers, the district is authorized to purchase, construct, acquire, own, operate, maintain, repair, improve, or extend inside and outside its boundaries, at any location whatsoever, in the sole discretion of the District, any and all works, improvements, facilities, plants, equipment, and appliances incident, helpful, or necessary to:

(1) provide, pursuant to the provisions of Chapters 5 and 6, Water Code, as amended, for the control, storage, preservation, transmission, treatment, and distribution and use of storm water and floodwater, the water of rivers and streams, and underground water, for irrigation, power, hydroelectric, and all other useful purposes, and to supply water for municipal, domestic, power, hydroelectric, industrial, oil flooding, mining, and commercial uses and purposes and all other beneficial uses and purposes;

(2) collect, transport, process, treat, dispose of, and control all municipal, domestic, industrial, or communal waste whether in fluid, solid, or composite state, including specifically the control, abatement, or reduction of all types of pollution; and it is hereby found and determined by the legislature that all of the aforesaid purposes are for the conservation and development of the natural resources of the state within the meaning of Article XVI, Section 59 of the Texas Constitution.

(b) The District may adopt, enforce, and collect all necessary charges, fees, or rentals for providing any District facilities or service and may require a deposit for any service or facilities furnished, and the District may or may not provide that the deposit will bear interest. The District may discontinue a facility or service to prevent an abuse or enforce payment of an unpaid charge, fee, or rental due to the District.

(c) All facilities acquired or constructed pursuant to this section shall be separate and apart from, and shall not constitute a part of, the District's water system established pursuant to that certain trust indenture securing North Texas Municipal Water District Revenue Bonds, Series 1954, dated September 1, 1954, and all additional bonds issued pursuant to said trust indenture, as supplemented. Bonds issued under this section shall not be issued as additional bonds under the aforesaid trust indenture, but shall be issued strictly under this section.

(d) The District is a "District" under the Regional Waste Disposal Act, as amended (Chapter 25, Water Code), and all provisions of said Act are applicable to this District except to the extent of any conflict with this Act, in which case the provisions of this Act shall prevail.

(e) All cities, public agencies, and other political subdivisions are authorized to contract with this District in any manner authorized by the Regional Waste Disposal Act, as amended (Chapter 25, Water Code), provided that any city is authorized to contract with this District in the manner authorized by Section 25.030 (c) of the Regional Waste Disposal Act.

(f) It is further specifically provided that the District and all cities, public agencies, and other political subdivisions shall have all of such rights, powers, and authority with respect to the control, storage, preservation, transmission, treatment, and disposition of storm water and floodwater, and the water of rivers and streams, and underground water as are granted, permitted, and authorized by the Regional Waste Disposal Act, as amended, (Chapter 25, Water Code), with respect to waste, waste disposal systems, and treatment facilities. Subsection (e) of this section shall be applicable to contracts made pursuant to this subsection.

(g) All cities, public agencies, and other political subdivisions are authorized to fix, charge, and collect fees, rates, charges, rentals, and other amounts for any service or facilities provided pursuant to or in connection with any contract with this District, and to pledge such amounts sufficient to make all payments required under the contract.

(h) For the purpose of providing funds to acquire, purchase, construct, improve, enlarge, and equip any property, buildings, structures, or other facilities for any purpose or power authorized by this section, the board of directors of the District may issue revenue bonds from time to time and in one or more issues or series, to be payable from and secured by liens on and pledges of all or any part of any of the revenues, income, or receipts derived by the District from its ownership, operation, lease, or sale of any such property, buildings, structures, or facilities, including the proceeds or revenues from contracts with any person, firm, corporation, city, public agency, or other political subdivision. Such bonds may be issued to mature serially or otherwise within not to exceed 50 years from their date, and provision may be made for the subsequent issuance of additional parity bonds, or subordinate lien bonds, under any terms or conditions that may be set forth in the resolution authorizing the issuance of the bonds. Such bonds, and any interest coupons appurtaining thereto, are and shall constitute negotiable instruments within the meaning and for all purposes of the Texas Uniform Commercial Code, provided that the bonds may be issued registerable as to principal alone or as to both principal and interest, and shall be executed, and may be made redeemable prior to maturity, and may be issued in such form, denominations, and manner, and under such terms, conditions, and details, and may be sold in such manner, at such price, and under such terms, and said bonds shall bear interest at such rates, all as shall be determined and provided in the resolution authorizing the issuance of the bonds. If so provided in the bond resolution, the proceeds from the sale of the bonds may be used for paying interest on the bonds during the period of the acquisition or construction of any facilities to be provided through the issuance of the bonds, for paying expenses of operation and maintenance of facilities, for creating a reserve fund for the payment of the principal of and interest on the bonds, and for creating any other

funds, and such proceeds may be placed on time deposit or invested, until needed, all to the extent and in the manner provided in the bond resolution. The District may pledge all or any part of its revenues, income, or receipts from fees, rentals, rates, charges, and contract proceeds or payments to the payment of the bonds, including the payment of principal, interest, and any other amounts required or permitted in connection with the bonds. The pledged fees, rentals, rates, charges, proceeds, or payments shall be fixed and collected in amounts that will be at least sufficient, together with any other pledged resources, to provide for all payments of principal, interest, and any other amounts required in connection with the bonds, and, to the extent required by the resolution authorizing the issuance of the bonds, to provide for the payment of expenses in connection with the bonds, and operation, maintenance, and other expenses in connection with the aforesaid facilities. Said bonds may be additionally secured by mortgages or deeds of trust on any real property owned or to be acquired by the District, and by chattel mortgages or liens or any personal property appurtenant to such real property; and the board of directors of the District may authorize the execution of trust indentures, mortgages, deeds of trust, or other forms of encumbrances to evidence same. Also, the District may pledge to the payment of the bonds all or any part of any grant, donation, revenues, or income received or to be received from the United States government or any other public or private source, whether pursuant to an agreement or otherwise.

(i) Any bonds issued pursuant to this section may be refunded or otherwise refinanced by the issuance of refunding bonds for such purpose, under such terms, conditions, and details as may be determined by resolution of the board of directors of the District. All pertinent and appropriate provisions of this section shall be applicable to such refunding bonds, and they shall be issued in the manner provided herein for other bonds authorized under this section; provided that such refunding bonds may be sold and delivered in amounts necessary to pay the principal, interest, and redemption premium, if any, of bonds to be refunded, at maturity or on any redemption date. Also, such refunding bonds may be issued to be exchanged for the bonds being refunded thereby. In the latter case, the Comptroller of Public Accounts of the State of Texas shall register the refunding bond and deliver the same to the holder or holders of the bonds being refunded

thereby, in accordance with the provisions of the resolution authorizing the refunding bonds; and any such exchange may be made in one delivery or in several installment deliveries. Bonds issued at any time by the District also may be refunded in the manner provided by any other applicable law.

(j) All bonds issued pursuant to this section and the appropriate proceedings authorizing their issuance shall be submitted to the Attorney General of the State of Texas for examination. When the bonds are to be issued to finance in whole or in part water-using facilities, except treatment or distribution facilities, before giving his approval the Attorney General shall be furnished a resolution from the Texas Water Rights Commission certifying that the District is possessed of the necessary water right authorizing it to impound and appropriate the water to be utilized by the project. Also, if the bonds recite that they are secured by a pledge of revenues of any contract, a copy of such contract and the proceedings relating thereto shall be submitted to the Attorney General. If he finds that such bonds have been authorized and any such contract has been made in accordance with law, he shall approve the bonds and any such contract, and thereupon the bonds shall be registered by the Comptroller of Public Accounts of the State of Texas; and after such approval and registration, such bonds and any such contract shall be incontestable in any court or other forum for any reason, and shall be valid and binding obligations in accordance with their terms for all purposes.

(k) All bonds issued pursuant to this section are legal and authorized investments for all banks, trust companies, building and loan associations, savings and loan associations, insurance companies of all kinds and types, and trustees, and for all interest and sinking funds and other public funds of the State of Texas and all agencies, subdivisions, and instrumentalities thereof, including all countries, cities, towns, villages, school districts, and all other kinds and types of districts, public agencies, and bodies politic. Said bonds also shall be eligible and lawful security for all deposits of public funds of the State of Texas and all agencies, subdivisions, and instrumentalities thereof, including all counties, cities, towns, villages, school districts, and all other kinds and types of districts, public agencies, and bodies politic, to the extent of the market value of said bonds, when accompanied by any unmatured interest coupons appurtenant thereto.

(l) This section shall be wholly sufficient authority within itself for the issuance of the bonds, the execution of contracts, and the performance of the other acts and procedures authorized herein by the District, and all cities, public agencies, and other political subdivisions, without reference to any other law or any restrictions or limitations contained therein, except as herein specifically provided; and in any case to the extent of any conflict or inconsistency between any provisions of this section and any other provision of law, this section shall prevail and control; provided, however, that the District and all cities, public agencies, and other political subdivisions shall have the right to use the provisions of any other laws, not in conflict with the provisions hereof, to the extent convenient or necessary to carry out any power or authority, express or implied, granted by this section.

(m) This Act does not compel any city, customer, or prospective customer to secure water, sewer service, or any other service from the District, except pursuant to contracts voluntarily executed.

(n) Nothing in this Act shall relieve the District from compliance with the provisions of Chapters 5, 6, and 50, Water Code, as amended.