ENGINEERING REPORT

REGIONAL WATER STUDY FOR ELLIS COUNTY AND SOUTHERN DALLAS COUNTY

PARTICIPATING AGENCIES

CITY OF ENNIS
CITY OF FERRIS
CITY OF ITALY
CITY OF MAYPEARL
CITY OF MIDLOTHIAN
CITY OF MILFORD
CITY OF PALMER
CITY OF RED OAK
CITY OF WAXAHACHIE
CITY OF WILMER
BOYCE W.S.C.
BRISTOL W.S.C.
BUENA VISTA BETHEL W.S.C.
EAST GARRETT W.S.C.
ROCKETT W.S.C.

ESPEY, HUSTON & ASSOCIATES, INC

IN ASSOCIATION WITH

ALAN PLUMMER & ASSOCIATES, INC.
AND
ENGINEERS

TRINITY RIVER AUTHORITY OF TEXAS
IN CONJUNCTION WITH THE
TEXAS WATER DEVELOPMENT BOARD
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ENGINEERING REPORT
REGIONAL WATER STUDY FOR
ELLIS COUNTY AND SOUTHERN DALLAS COUNTY

Prepared in Conjunction with:

The Texas Water Development Board
and
The Trinity River Authority of Texas
for

City of Ennis
City of Ferris
City of Italy
City of Maypearl
City of Midlothian
City of Milford
City of Palmer
City of Red Oak
City of Waxahachie
City of Wilmer
Boyce W.S.C.
Bristol W.S.C.
Buena Vista Bethel W.S.C.
East Garrett W.S.C.
Rockett W.S.C.

Prepared by:

Espey, Huston & Associates, Inc.
in association with
Alan Plummer & Associates
and
Rone Engineers

May 1989

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REGIONAL WATER STUDY FOR
ELLIS COUNTY AND SOUTHERN DALLAS COUNTY

1.0 EXECUTIVE SUMMARY

In 1988, fifteen agencies joined together to document and plan for the future water needs of Ellis County and the City of Wilmer. Many efforts have been undertaken over the years by some of the study participants to secure more and better potable water, but these have been largely unsuccessful. Ground-water supplies have deteriorated in quality and quantity, and existing surface water reservoirs are limited as well. Therefore, the Study Area has become the focus for future growth. With the recent announcement of the Superconducting Super Collider coming to Ellis County, there is a general recognition that new supplies must be found. A more critical fact is that no regional entity has the responsibility to develop water supplies and deliver potable water to the various communities and utilities in the Study Area.

The study was conducted under the general guidelines of a 15-member Steering Committee consisting of one representative from each participating agency and the Trinity River Authority of Texas (TRA). The Texas Water Development Board (TWDB) participated and awarded a matching grant to help fund the project. Other regional water studies, in progress during this study, were coordinated with, including the Dallas Water Utilities Long-Range Water Supply Plan and the Collin County Water Study. The study was conducted by the Study Team, which consisted of Espey, Huston & Associates, Inc. (EH&A), Alan Plummer and Associates, Inc. (APAI) and Rone Engineers (RE).

This report presents conclusions and recommendations to facilitate implementation of a system to treat and deliver surface water to the fifteen cities and water supply corporations in the Ellis County and Southern Dallas County Regional Water Study, hereinafter referred to as Study Area.

1. Surface water requirements for participating entities in the study have been estimated for the following milestone years, based on the development of the Superconducting Super Collider in Ellis County:

Year	Gross Surface Demand (MGD)
1990	11.07
2000	15.09
2010	20.79
2020	27.92
2030	34.90

2. That Alternate Number 1 (TCWCID No. 1 and Terminal Storage), which involves obtaining raw water from the Tarrant County Water Control and Improvement District No. 1, be selected for the development of an Ellis County/Southern Dallas County Regional Water Supply System.

3. That the Trinity River Authority of Texas (TRA) be asked to serve as the Regional Agency responsible for implementing the system.

4. The Regional Agency should coordinate with those entities desiring to purchase water, to develop a Phase I Implementation Plan, identifying those elements of the regional system which are most needed and cost-effective to be implemented in an incremental manner.

5. The role of the Regional Agency would be to develop, own and operate a raw water delivery system consisting of water from the TCWCID No. 1, delivered for terminal storage in Waxahachie, Bardwell and Joe Pool Lakes,

and for the sale of treated water to entities not currently owning surface water treatment plants.

6. Water should be treated at the three existing water treatment plants currently owned by the Cities of Ennis and Waxahachie and the Midlothian Water District. These plants will remain the property of the owning cities. Transmission systems will be developed as need and economics justify. The Regional Agency will develop these transmission systems.

7. It will be necessary for all of the member entities to pass water conservation plans modeled after TWDB guidelines to affect the efficient use of water.

8. The probable capital cost for the proposed facilities for the initial system development is as follows:

Description	Year 1990
o Raw Water Delivery	$2,555,000
o Treatment and Conveyance	$25,012,000
o Contingencies and Financing	$12,687,000
Total Probable Capital Cost	$40,254,000

9. The initial average system-wide cost of water to the point of delivery, based on the sale of 11.07 MGD in the year 1990, is $2.81 per 1,000 gallons of water, depending on terms to be negotiated with the TCWCID No. 1, and with parties which pledge their facilities to the regional system.

10. Initial improvements can be scheduled to be in place and operating in 18 to 24 months.

11. Should ongoing studies by TCWCID No. 1 and the City of Dallas identify reservoirs in the mid-Trinity Basin as projects which should be considered with other partners, the regional authority should analyze the option of joining such a venture at that time.

12. Planning and implementation of regionalized wastewater systems, when economically viable, should be ongoing and opportunities for reuse sought as supplemental water supply.

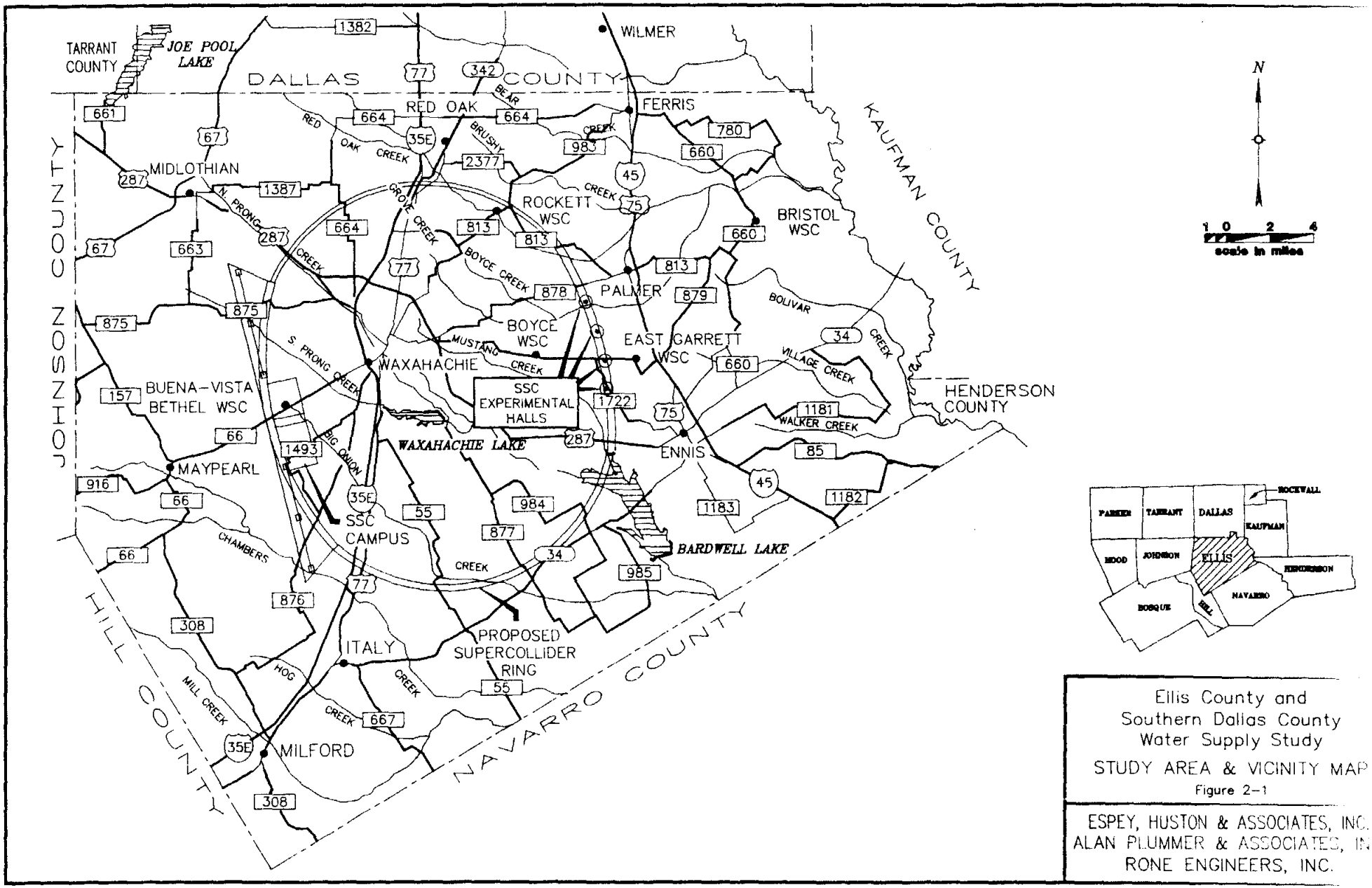
2.0 INTRODUCTION

In May 1988, TRA contracted with the study team of Espey, Huston & Associates, Inc., Alan Plummer & Associates, Inc. and Rone Engineers to conduct a comprehensive water study for Ellis County and Southern Dallas County. The overall Study Area is shown in Figure 2-1. The following cities and water supply corporations participated in this study:

City of Ennis
City of Ferris
City of Italy
City of Maypearl
City of Midlothian
City of Milford
City of Palmer
City of Red Oak
City of Waxahachie
City of Wilmer
Boyce W.S.C.
Bristol W.S.C.
Buena Vista Bethel W.S.C.
East Garrett W.S.C.
Rockett W.S.C.

In addition, the TWDB awarded a 50% planning grant to help fund the project.

This study has been coordinated with other regional studies including the update to the Dallas Water Utilities (DWU) Long-Range Water Supply Plan for the Period 1990-2050. The DWU planning area includes portions of Dallas, Denton, Collin, Grayson and Cooke Counties. The planning area for the Dallas study includes the City of Wilmer; consequently, there is a slight overlap in the two studies.



Ellis County and
Southern Dallas County
Water Supply Study

STUDY AREA & VICINITY MAP

Figure 2-1

ESPEY, HUSTON & ASSOCIATES, INC.
ALAN PLUMMER & ASSOCIATES, IN
RONE ENGINEERS, INC.

The purpose of the Ellis County and Southern Dallas County Regional Water Supply Study is to develop a regional water supply plan to serve the participants in the Study Area. The study addresses prospective population growth in the region, water service demand factors, projected water needs of the overall Study Area as well as those of the study participants, various approaches for providing regional utility service and the relative feasibility of the alternatives considered. The following principal items were included in the scope of work:

a. Collect and review data, previous reports and maps pertinent to water supply, treatment and distribution in the Study Area.

b. Evaluate historical data and develop projections for population, per capita usage and water demands for the years 1980, 1987, 1990, 2000, 2010, 2020 and 2030.

c. Identify and evaluate potential water supply sources to meet the needs of the planning area.

d. Prepare conceptual infrastructure plans for the proposed water supply, water transmission, treatment and distribution.

e. Review types of institutional organizations which may be utilized to finance, develop, operate and maintain the recommended water supply system.

f. Schedule implementation of the recommended water supply system.

2.1 STUDY AREA DESCRIPTION

South of Dallas along Interstate Highway (IH) 35 East or IH-45 is Ellis County, which covers 939 square miles. The County is bounded on the north by Dallas County, east by the Trinity River and Kaufman County, on the south by Navarro County and on the west by Hill and Johnson Counties. The Study Area for this project includes all of Ellis County plus the City of Wilmer, which is located just north of the County along IH-45.

The Study Area lies in the Blackland Prairies vegetation. The area is nearly level to gently rolling plain with gently sloping uplands. The soils are deep clay loams and clay. The climate of the region is mild, with an average annual temperature of 66°F.

2.1.1 Topography

The topography of Ellis County slopes to the east and southeast toward the Trinity River. Red Oak Creek is located in the northern part of the County, and flows more or less easterly. Waxahachie Creek, a tributary of Chambers Creek, rises in the northwestern part of the County and flows diagonally across the County in a southeasterly direction. Waxahachie and Bardwell Lakes are located on this tributary system. Chambers Creek, whose headwaters originate in Johnson County, enters Ellis County at about the midpoint of its western boundary, then flows southeasterly across the County, exiting at the approximate midpoint of its southern border.

2.1.2 Rainfall and Evaporation

Average annual rainfall across the County ranges from 34 inches on the west side to in excess of 37 inches on the east side. Highest precipitation is experienced in April and May. January, July and August represent the periods of least rainfall. All other months range from 2.5 inches to slightly above 3 inches of rainfall.

According to the TDWR report, "Climate Atlas of Texas," LP-192, December 1983, the annual average gross lake surface evaporation rate for Ellis County for the period 1950-1979 varied from 63 inches at the eastern edge of the county to 66 inches at the western edge. Monthly evaporation in the center of the county ranges from 2-1/3 inches in January to 9-1/8 inches in August. Average annual precipitation in Ellis County (near its center) is 36.0 inches (1951-1980), thereby resulting in a rainfall deficit of approximately 27 inches per year over the long term.

2.1.3 Geology

The geology of Ellis County is represented by outcrops of formations of the Cretaceous age. The Eagle Ford Formation outcrop forms the western portion of the County. It appears essentially as a treeless plain transitioning into minor foothills gathered next to the topographic feature called the Escarpment. Outcropping east of the Eagle Ford formation is the Austin Chalk formation. Its lower member is massive limestone. This member, being significantly more resistant to erosion, has formed the high ground of the Escarpment, which dominates the western portion of the County. At the eastern side of the County, the Taylor formation outcrops. Both the Austin Chalk and Taylor Marl support prime agricultural soils. The formations dip somewhat uniformly to the southeast at about 1%. Some minor faulting has been noted, but is of minor consequence.

2.1.4 Present Water Supply Sources

The present sources of water involve a mix of both surface and ground water. The larger cities have converted to surface water almost exclusively. The Midlothian Water District has just completed (1988) a 3.0-MGD water treatment facility that will allow it to use a portion of its contracted portion of Joe Pool Lake (5.95 MGD). The Midlothian Water District is also hopeful of supplying nearby water supply districts with treated surface water. The City of Ennis (with customer entity the East Garrett Water Supply Corp.) and the City of Waxahachie (through the Ellis County Water Supply District) both utilize Bardwell Lake (permitted diversion: 9,400 ac-ft/yr) for water supply. The City of Waxahachie also independently utilizes Waxahachie Lake (permitted diversion: 3,570 ac-ft/yr) a source of raw water. The remainder of the Study Area uses ground water.

According to the Texas Department of Water Resources (TDWR), Occurrence, Availability and Chemical Quality of Ground Water in Cretaceous Aquifers of North-Central Texas, Report 269, April 1982, the major aquifers in the County are the Woodbine formation and the Lower Trinity formations. The Woodbine underlies the Study Area ranging from 290 feet

mean sea level (msl) at Midlothian to -750 feet msl in the vicinity of Ennis. Numerous wells have been completed in the Woodbine. Typical yields of from 120 to 200 gpm have been reported.

The Lower Trinity formations (including Paluxy, Twin Mountains and Basal Cretaceous sands) underlie the Study Area. The Paluxy lies at -485 feet msl at Midlothian and -1,900 feet msl at Ennis. The Twin Mountains formation is at -1,130 feet msl at Midlothian and -2,850 feet msl at Ennis. Typical yields from the Paluxy aquifer range from 68 to 190 gpm in nearby counties, with one well in Ennis that is reported to yield 79 gpm on a drawdown test. The Twin Mountain is reported to average 300 gpm in Ellis County.

Ground-water usage in north-central Texas has caused significant declines in ground-water levels. TDWR Report 269, previously referenced, details the ground-water usage practices which have resulted in these declines. A large cone of depression exists in the Dallas/Fort Worth area involving the Paluxy and Twin Mountain formations. The static water levels have declined to the top of the Paluxy, which indicates that dewatering of the aquifer has begun. Rates of decline on the order of 20 feet per year are reported between Dallas and Tarrant Counties. Both of these counties have abandoned most of their wells and have turned to surface water sources, which has alleviated the problem of ground-water decline somewhat. However, the report concludes that the large quantity of ground water pumped from surrounding areas will cause a continuation of the trend in water level declines. For northeast Texas, the annual recharge is estimated at 51,000 ac-ft/yr, while use has averaged 63,000 ac-ft/yr. This large discrepancy indicates the aquifer is overdeveloped and continued pumpage at current rates will continue to deplete storage.

The Woodbine Aquifer is an important source of ground water in the Study Area. Unlike the Trinity Group, the Woodbine is not overdeveloped (average use of 10,060 ac-ft/yr in 1976 vs. 24,500 ac-ft recharge over the entire aquifer). Yields of Woodbine wells are much lower on the average than Trinity Group wells, making their unit costs of water developed much higher. TDWR Report 269 indicates that localized decline can be anticipated if heavy pumping occurs. Within the Study Area, the report provides long-term data on one well (JK-32-48-501) near

Maypearl which shows a drawdown of 32 feet over 8 years (1970-1977). In general, the Woodbine water levels declined about 100 feet county-wide over the period 1955 to 1976.

Water quality problems were reported by many of the participants that were interviewed as a part of this study. Typical comments ranged from taste and odor to specific constituents, such as fluoride, sulfides, iron and dissolved solids. Turbidity and temperature were also cited as examples of water quality problems.

Temperatures have been recorded in TWDB Report 198, Water-Level and Water-Quality Data from Observation Wells in Northeast Texas, February 1976 for the following wells:

Well No.	Year	Formation	Temp.
33-50-502	(1965)	Woodbine Aquifer	86°F
33-41-202	(1965)	Woodbine Aquifer	81°F
33-36-201	(1965)	Woodbine Aquifer	102°F

A review of published water quality information was also made. Except for fluoride, there are no problems with ground water meeting the primary standards. There is a possibility of some of the Woodbine ground water exceeding the nitrate standard. With respect to the secondary standards, the Woodbine water exceeds the standards for sulfates and dissolved solids, as does the Paluxy Formation. Some of the Woodbine water exceeds the chloride standard. The Twin Mountain Aquifer apparently meets all standards. Table 2-1 shows parameters that exceed the applicable standard. Based on water quality information received from some of the participants, all other parameters of area ground water are within the standards.

In summary, ground-water supplies in the Study Area are dwindling. Well productivity is generally low and the water is of marginal quality and high temperature. Additionally, the Study Area is within a larger area which has been designated by the Texas Water Commission (TWC) and the TWDB for study to potentially establish all or part of the area as a Critical Groundwater Management Area.

TABLE 2-1

WATER QUALITY PARAMETERS OF AREA GROUND WATER
THAT EXCEED APPLICABLE STANDARDS

Selected Parameter	Standard[1] (mg/l)	Woodbine Table 14 TDWR Report 269 (range) (mg/l)	Paluxy Table 12 TDWR Report 269 (range) (mg/l)	Twin Mountain Page 108 TWDB Report 198 (mean) (mg/l)
Primary				
Nitrate	10	0-50	0.4-3.6	0.9
Fluoride	4.0	0-7.9	5.4-7.0	1.6
Secondary				
Sulfate	250	16-586	354-864	149
Dissolved Solids	500	429-3,032	1,250-1,999	894
Chloride	250	17-1,310	54-74	131

[1] U.S. EPA National Primary Drinking Water Regulations, 1988.

Consequently, ground water will not be considered among the primary alternatives for this study. However, it represents a significant source of water that will be available both in the transition period of developing alternative sources and in some cases providing long-term supplies. In addition, ground-water well systems should also be maintained into the future to provide back-up supply or augmentation supply during periods of drought or limited surface water supply.

2.1.5 General Development Considerations

This region at one time led the State in the production of cotton. Although there has been a diversification of crops, the area is still primarily agricultural.

Even though agricultural land occupies most of the County, urbanization is gradually taking over. The primary forces that are expected to influence development trends of Ellis County are presented below.

Population and Water Demand

1. Proximity to Dallas and Tarrant Counties. As the Dallas/Fort Worth (DFW) Metroplex continues to grow, the Study Area will also experience growth due to its proximity. In addition, the Study Area represents an appealing alternative location for businesses and residential communities to serve the major DFW area.

2. Major Highway Systems that Link Major Market Areas. Both IH-35 and IH-45 cross the depth of Ellis County, linking the DFW Metroplex, Waco, Austin, San Antonio and Houston. These highways also provide easy access to the Metroplex from Ellis County. This access is expected to improve since the State Highway Department is currently involved in developing plans to widen IH-45 to 6 lanes between Dallas and Houston.

3. Growth Centers Within the County. Three cities--Midlothian, Ennis and Waxahachie--are all experiencing growth. Each city is aggressively seeking business and industry relocations, and is providing for the necessary infrastructure to support growth.

4. Superconducting Super Collider (SSC). The SSC is a scientific instrument which creates and studies the collision of atomic particles, which is important for studying how and why the universe is put together. This proton-proton collider has an energy of 40 trillion electron volts (TeV), 20 times the energy of what is presently the highest energy accelerator in the world, the Tevatron collider located in Illinois. At near the speed of light, two beams of protons, the positively charged constituents of atoms, collide. Scientists then observe the results of these collisions. The SSC will continue scientists' search for the fundamental nature of matter and energy. Continued progress in high-energy physics research in the mid-1990's requires the study of collisions at energy levels that cannot be achieved with any accelerator now in operation or under construction.

   Advances in basic knowledge contribute to the economic and technological competitiveness of the nation through applications of discoveries and new knowledge.

   - o Basic research has yielded countless discoveries in medicine, electronics, communications and computers.
   - o Further progress in science and technology depends on increased understanding of matter and energy.
   - o Progress in high-energy physics requires study of collisions at energy levels not presently achievable.
   - o The SSC will answer many heretofore unanswerable questions about particles and their interactions.

- This research will have practical applications of great significance to science and technology.

The SSC will have two research campuses. The heart of the super collider is two rings of magnets located in a 52-mile circumference tunnel. The oval-shaped tunnel is 10 feet in cross-sectional diameter. Other facilities include four large interaction halls where experiments will be conducted, a series of interjector accelerators, and technical support buildings and offices.

Construction cost for the accelerator and laboratory is estimated to be $3.2 billion (FY 1988 dollars); costs of research and development, detectors, computers and pre-operating activities are approximately $1.2 billion (FY 1988 dollars) for a total of $4.4 billion. In addition, construction of utilities including electrical energy, communications, natural gas, industrial and potable water, sewage, and solid and hazardous waste disposal will be required to operate the SSC.

In November 1988, Ellis County was selected as the site for the SSC. The SSC ring will be centered around Waxahachie. The construction activities and site operations will materially affect the population and attendant water supply needs. Water sources for the SSC will include both surface and ground water. Remote sites will be supplied by ground-water wells constructed at points of use. The "Far Cluster," which will be located within the City of Ennis, contains four of the six SSC Experiment Halls, and will be supplied with potable water from the City of Ennis as stipulated in the TNRLC proposal to the Department of Energy. In addition, industrial cooling water will be supplied at the Far Cluster from ground-water wells. The Near Cluster will be served by surface water. The surface water needs for the SSC have been estimated to be 1.58 MGD, and this need has been incorporated into the study (see letter dated May 19, 1988,

in Appendix). However, the study also considers the condition without the SSC, even though the selection has been made, given the uncertainty of future funding.

Ellis County is positioned to realize significant growth through the planning horizon of 2030. Beyond that, it should continue to experience growth in excess of the State's average annual growth rate. Accordingly, this study will investigate the effect this growth will have on the ability of the existing supply to meet the future needs and develop solutions that provide a reliable water supply through the planning horizon. The study will also identify alternatives that should be considered beyond the planning horizon.

2.2 REFERENCES

Bureau of Economic Geology, University of Texas. 1975. The Geology of Texas. Vol. I, Stratigraphy.

Texas Department of Water Resources. 1976. Water Level and Water Quality Data from Observation Wells in Northeast Texas. Report 198.

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_____. 1977. Trinity River Basin Master Plan. Amended in 1984, 1989.

3.0 POPULATION AND WATER DEMAND PROJECTIONS

3.1 REVIEW OF PLANNING DATA

Given the wide variety of governmental jurisdictions and utility providers, pertinent data was compiled from many different sources. Major data sources included questionnaires, related studies and governmental agencies such as the North Central Texas Council of Governments (NCTCOG), the TRA, the U.S. Army Corps of Engineers (USCE) and the TWDB. In addition, individual interviews were conducted with each of the study participants. A complete list of documents that were reviewed to obtain relevant planning information is included at the end of this section.

3.2 PLANNING PARAMETERS AND METHODOLOGY

Regional water supply planning is a complex, technical undertaking which requires careful and detailed consideration of local and regional population growth, as well as historical water consumption trends, since population and per capita usage are the basic components used in determining future water demand. The water requirements are then used to identify facility requirements for the appropriate design year. The planning horizon for this project has been set at the year 2030, with projections of population and water demands at the milestone years of 1990, 2000, 2010 and 2020. In addition, historical data from 1980 and 1987 is provided for informational purposes. Population and water demand projections have been developed for two scenarios: with and without the SSC.

In this study, projections were developed by evaluating existing data collected from the various entities. This evaluation is explored further in the following sections.

3.3 DEVELOPMENT OF POPULATION PROJECTIONS

Anticipated population growth is the basis for planning future water systems. Various existing sources of regional and local information were explored for this study, including input

from representatives of the participating entities. This section discusses the primary data sources and the development of the population projections selected for use.

3.3.1 U.S. Bureau of the Census

The Study Team used the 1980 Census of Population and the 1986 Estimates of Population for the purpose of establishing a baseline population and historical population trends.

3.3.2 North Central Texas Council of Governments

The Study Team examined the population projections produced by NCTCOG in 1988. These projections were developed to the year 2010, and were available for Ellis County as a whole and the cities of Red Oak, Ferris and Wilmer. NCTCOG city and county projections were compared with projections from other sources. The other cities in the Study Area are not in NCTCOG's primary planning area and, therefore, no NCTCOG projections are available.

NCTCOG also published population estimates for 1987. These estimates were developed for cities with a population greater than 1,000 as of January 1, 1987. Estimates were available for Ennis, Ferris, Italy, Midlothian, Palmer and Wilmer. Again, the other cities/entities in the Study Area have not been projected by NCTCOG. This data was useful in developing growth rates for comparison with other sources.

3.3.3 Texas Water Development Board

The TWDB prepared high and low population projections for larger communities and counties for use in the Texas Water Plan. The TWDB relies on the cohort-component (survival) technique to prepare its population projections--a technique designated by sociologists and economists as the most rigorous approach available. A cohort is defined as a group of people having similar characteristics. In developing these projections, TWDB used sixteen age groups, three ethnic groups and two gender groups, making a total of 96 cohorts used. Births, deaths and migration rate characteristics of each cohort are also used in making the projections.

First the population in 1980 is divided into an age/race/sex cohort matrix. Then, to each cell of the matrix, characteristic birth, death and migration rates are applied to determine the cohort population for the next projection date. The TWDB population projections are divided into 5-year intervals. The following equation was used to project the population of each cohort:

$$P_t+5 = P_t + B - D + M$$

where:
- P^{t+5}_t = population of a cohort 5 years after the initial date t;
- P_t = population of a cohort at the initial date;
- B = births for a cohort between times t and t+5;
- D = deaths of a cohort between times t and t+5; and
- M = net migration for a cohort.

The high and low projections for the Study Area are as shown in Table 3-1.

The average annual growth rates between 1980 and 2030 for the high and low scenarios are 1.94% and 1.50%, respectively. These projections were revised at the county level in 1986 to reflect recent Census estimates. The revised projections for Ellis County, with a high growth rate of 2.25% and a low growth rate of 1.91%, are also shown in Table 3-1.

After the announcement that the SSC would be located in Ellis County, these high projections were adjusted further by the TWDB. The new high projection has an average annual growth rate of 2.39%, and is shown in Table 3-1.

3.3.4 U.S. Army Corps of Engineers

Simultaneously but unrelated to this study, the USCE (Fort Worth District) is studying the possibility of raising the conservation pool in Bardwell Lake (the USCE Bardwell Lake study is discussed in more detail in Section 4.0). A draft report was obtained that contained population

TABLE 3-1

TEXAS WATER DEVELOPMENT BOARD POPULATION PROJECTIONS

	1980	1990	2000	2010	2020	2030
Projections for Ellis County (developed in 1984)						
High	59,743	75,586	97,231	120,140	140,107	156,041
Low	59,743	72,418	85,666	99,586	113,420	125,732
Revised Projections for Ellis County (developed in 1986)						
High	59,743	85,359	117,257	141,972	163,760	181,539
Low	59,743	82,359	105,063	122,111	139,098	154,062
Adjusted High (based on selection of Ellis County for SSC)	59,743	91,609	125,845	152,386	175,751	194,832

projections for the Cities of Ennis and Waxahachie to the year 2040. These projections were compared to other sources.

3.3.5 Local Planning and Engineering Studies

Many of the participating cities and service providers have conducted planning studies which included population projections. The results of methodological approach of each of these were examined for reasonableness and insight into local development and growth patterns. In addition, current population information was also obtained from the Texas Municipal League.

3.3.6 Participant Surveys and Interviews

In addition, the Study Team also coordinated closely with local officials to solicit insight into local growth patterns and known development activity. Each participant provided locally-derived population projections in a survey of participants and in follow-up interviews. A copy of the questionnaire form is provided in the Appendix.

3.3.7 Evaluation of Various Approaches

Although there were variations from one community to another, some general patterns emerged for the Study Area:

1. Population projections by NCTCOG generally fell between the high and low projections developed by the TWDB for the Texas Water Plan.

2. The TWDB indicates that average annual growth rates for Ellis County will range from 1.91% without the SSC to 2.39% with the SSC.

3. The USCE projections for Ennis and Waxahachie were higher than those developed by the TWDB.

4. Several of the participating entities had projections that were significantly higher than the regionally-based projections. This may be due to better knowledge of local economic and development conditions or a tendency to conservatively estimate the rates of growth in their community to ensure adequate services for existing and future residents.

3.3.8 Technical Approach

Given the data discussed above, the Study Team prepared population projections for planning purposes based on the following:

1. The 1980 Census figures were adopted for the cities, and "number of connections" data from the water supply corporations were used to estimate 1980 population for these entities.
2. The study population projections were developed for the most part on the basis of existing projections developed by others, primarily those of the TWDB. The Study Team projections are generally slightly higher than those developed by the TWDB.
3. Planning projections were reviewed with the study participants and the TWDB. Some adjustments were made as a result of this review.
4. Due to the uncertainty of the impact that the SSC will have in the Study Area, a high and low range of projections were developed for this scenario. Projections were also developed for the "without SSC" scenario.

3.3.9 Population Projections

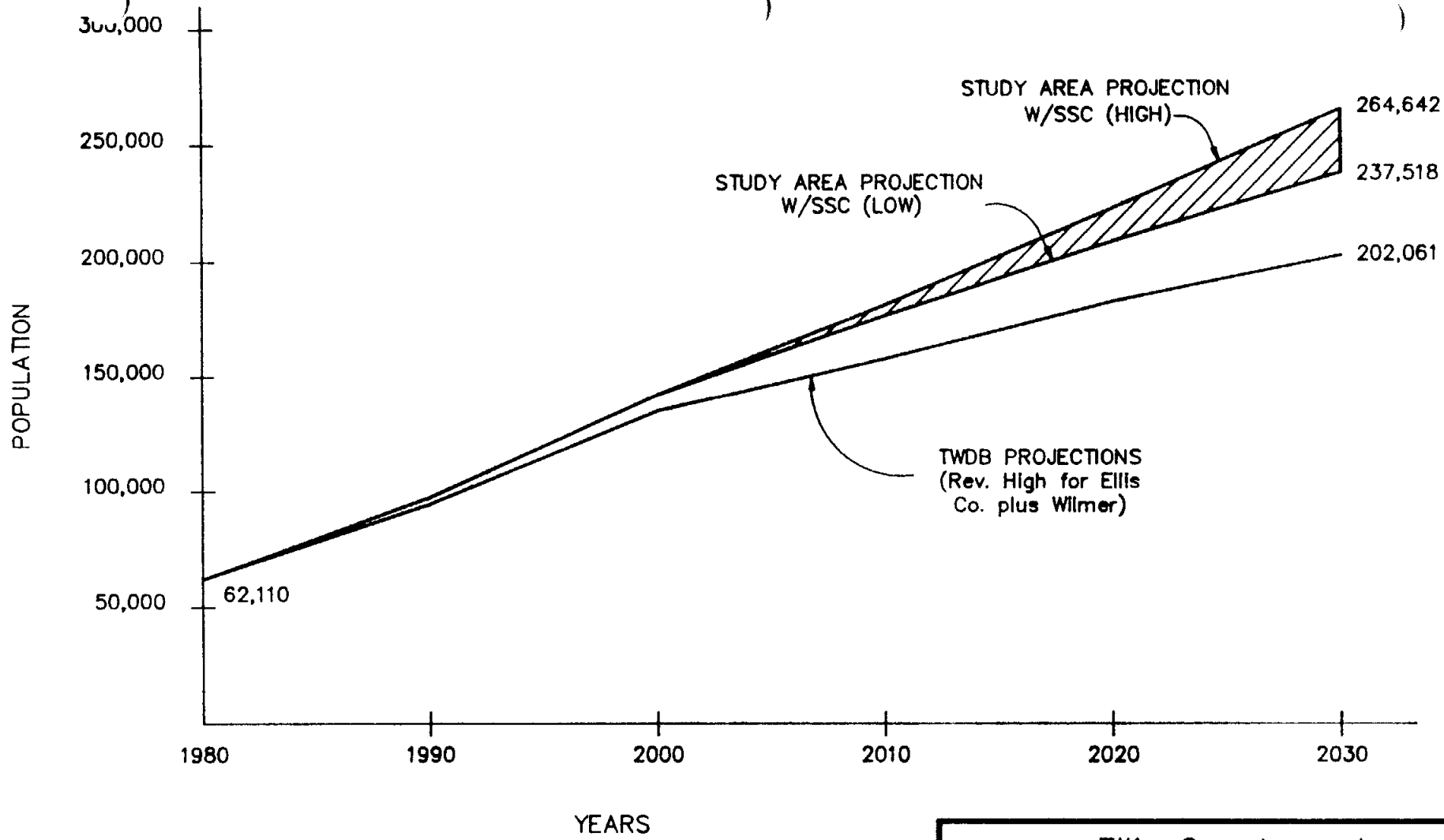
Table 3-2 shows the population projections selected for planning purposes. These projections indicate an overall growth rate ranging from 2.72% to 2.94% for the "with SSC" scenario and an average annual growth rate of 2.38% for the "without SSC" scenario. As previously discussed, these projections are generally higher than those prepared by the TWDB. Figures 3-1 and 3-2 illustrate the difference between the selected planning projections for the

TABLE 3-2
POPULATION PROJECTIONS

ENTITY		1980	1987	1990	2000	2010	2020	2030	AVG. ANNUAL GROWTH RATE 1980 - 2030
ENNIS									
	W/SSC (HIGH)	12,110	13,650	16,000	22,807	29,756	37,353	45,088	2.66%
	W/SSC (LOW)	12,110	13,650	16,000	22,807	27,322	31,113	35,736	2.19%
	W/O SSC	12,110	13,650	15,960	20,216	24,977	29,126	32,438	1.99%
FERRIS									
	W/SSC (HIGH)	2,228	2,525	2,791	3,485	4,306	5,022	5,593	1.86%
	W/SSC (LOW)	2,228	2,525	2,791	3,485	4,306	4,770	5,313	1.75%
	W/O SSC	2,228	2,525	2,748	3,304	4,005	4,644	5,174	1.70%
ITALY									
	W/SSC (HIGH)	1,306	1,650	1,899	2,776	3,803	5,012	6,230	3.17%
	W/SSC (LOW)	1,306	1,650	1,899	2,776	3,803	4,761	5,918	3.07%
	W/O SSC	1,306	1,650	1,765	2,040	2,472	2,367	3,193	1.80%
MAYPEARL									
	W/SSC (HIGH)	626	729	911	1,332	1,825	2,405	2,989	3.18%
	W/SSC (LOW)	626	729	911	1,332	1,825	2,285	2,839	3.07%
	W/O SSC	626	729	750	927	1,101	1,262	1,398	1.62%
MIDLOTHIAN									
	W/SSC (HIGH)	3,219	4,350	7,135	10,975	16,246	22,916	30,547	4.60%
	W/SSC (LOW)	3,219	4,350	7,135	10,975	16,246	21,770	27,400	4.38%
	W/O SSC	3,219	4,350	7,026	10,602	14,955	20,500	24,236	4.12%
MILFORD									
	W/SSC (HIGH)	681	710	990	1,447	1,982	2,612	3,246	3.17%
	W/SSC (LOW)	681	710	990	1,447	1,982	2,418	3,083	3.07%
	W/O SSC	681	710	776	959	1,140	1,307	1,448	1.52%
PALMER									
	W/SSC (HIGH)	1,187	1,550	2,066	2,658	3,284	3,830	4,266	2.59%
	W/SSC (LOW)	1,187	1,550	2,066	2,658	3,284	3,639	4,052	2.49%
	W/O SSC	1,187	1,550	2,034	2,520	3,054	3,542	3,946	2.43%
RED OAK									
	W/SSC (HIGH)	1,882	2,425	3,568	6,095	9,465	13,351	17,943	4.61%
	W/SSC (LOW)	1,882	2,425	3,568	6,095	9,465	10,985	12,400	3.84%
	W/O SSC	1,882	2,425	3,000	4,072	5,744	7,719	8,500	3.06%
WAXAHACHIE									
	W/SSC (HIGH)	14,624	18,550	21,448	28,352	35,038	41,676	47,188	2.37%
	W/SSC (LOW)	14,624	18,550	21,448	28,352	34,560	40,306	44,828	2.27%
	W/O SSC	14,624	18,550	20,305	25,387	30,122	35,482	39,780	2.02%

TABLE 3-2
POPULATION PROJECTIONS

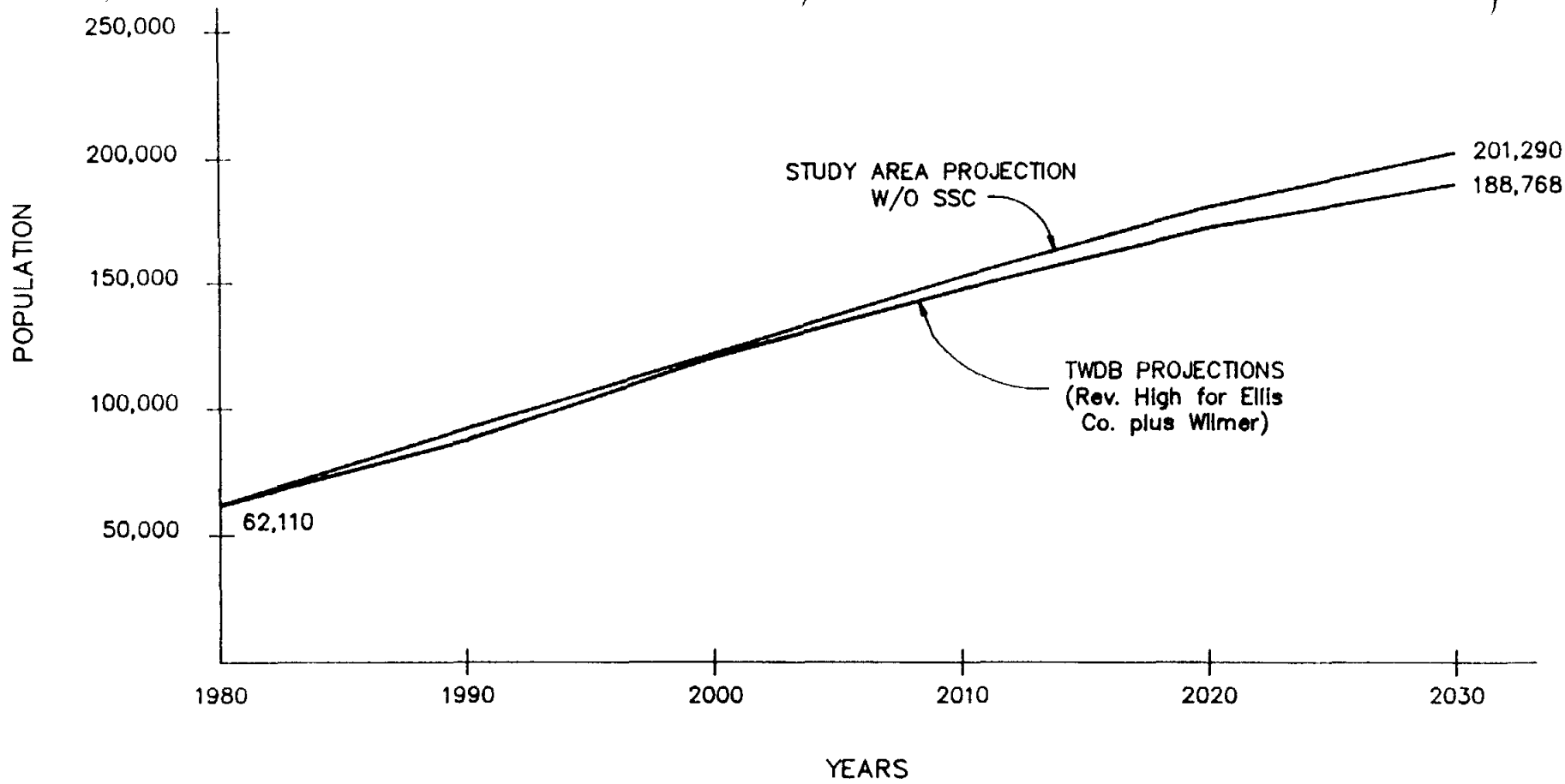
ENTITY	1980	1987	1990	2000	2010	2020	2030	AVG. ANNUAL GROWTH RATE 1980 - 2030
WILMER								
W/SSC (HIGH)	2,367	3,154	3,504	4,672	5,656	6,525	7,229	2.26%
W/SSC (LOW)	2,367	3,154	3,504	4,672	5,656	6,199	6,867	2.15%
W/O SSC	2,367	3,154	3,340	3,652	3,987	4,356	4,724	1.39%
BOYCE WSC								
W/SSC (HIGH)	900	1,022	1,163	1,653	2,001	2,309	2,558	2.11%
W/SSC (LOW)	900	1,022	1,163	1,653	2,001	2,194	2,430	2.01%
W/O SSC	900	1,022	1,075	1,413	1,643	1,871	2,075	1.68%
BRISTOL WSC								
W/SSC (HIGH)	594	675	768	1,092	1,322	1,525	1,690	2.11%
W/SSC (LOW)	594	675	768	1,092	1,322	1,449	1,605	2.01%
W/O SSC	594	675	709	932	1,084	1,235	1,370	1.69%
BUENA VISTA WSC								
W/SSC (HIGH)	1,424	1,617	2,070	3,026	4,146	5,465	6,794	3.17%
W/SSC (LOW)	1,424	1,617	2,070	3,026	4,146	5,192	6,454	3.07%
W/O SSC	1,424	1,617	1,700	2,234	2,598	2,959	3,282	1.68%
EAST GARRETT WSC								
W/SSC (HIGH)	671	762	867	1,232	1,492	1,721	1,907	2.11%
W/SSC (LOW)	671	762	867	1,232	1,492	1,635	1,811	2.01%
W/O SSC	671	762	801	1,053	1,224	1,394	1,546	1.68%
ROCKETT WSC								
W/SSC (HIGH)	7,263	15,036	20,073	28,534	34,544	39,853	44,153	3.68%
W/SSC (LOW)	7,263	15,036	20,073	28,534	33,940	38,240	41,953	3.57%
W/O SSC	7,263	15,036	18,510	24,325	28,285	32,216	35,727	3.24%
OTHER CITIES								
W/SSC (HIGH)	2,552	2,924	3,430	4,890	6,296	7,834	9,382	2.64%
W/SSC (LOW)	2,552	2,924	3,430	4,890	6,296	7,442	8,382	2.41%
W/O SSC	2,552	2,924	3,083	3,997	4,773	5,426	6,260	1.81%
OTHER RURAL AREAS								
W/SSC (HIGH)	8,476	9,293	9,999	15,299	21,580	24,509	27,839	2.41%
W/SSC (LOW)	8,476	9,293	9,999	15,299	21,580	24,149	26,447	2.30%
W/O SSC	8,476	9,293	9,643	14,378	20,954	23,789	26,193	2.28%
STUDY AREA TOTAL								
W/SSC (HIGH)	62,110	80,622	98,682	140,325	182,742	223,918	264,642	2.94%
W/SSC (LOW)	62,110	80,622	98,682	140,325	179,226	208,547	237,518	2.72%
W/O SSC	62,110	80,622	93,225	122,011	152,118	179,195	201,290	2.38%



STUDY AREA POPULATION PROJECTIONS
(W/SSC SCENARIO)
VS
TWDB PROJECTIONS

Ellis County and
Southern Dallas County
Water Supply Study
Figure 3–1

ESPEY, HUSTON & ASSOCIATES, INC.
ALAN PLUMMER & ASSOCIATES, INC.
RONE ENGINEERS, INC.



STUDY AREA POPULATION PROJECTIONS
(W\O SSC SCENARIO)
VS
TWDB PROJECTIONS

Ellis County and
Southern Dallas County
Water Supply Study
Figure 3-2

ESPEY, HUSTON & ASSOCIATES, INC.
ALAN PLUMMER & ASSOCIATES, INC.
RONE ENGINEERS, INC.

Study Area and the TWDB projections. The projections are similar to the year 2010, but begin to diverge at this point. Study projections were utilized for plan formulation because these forecasts represent a reasonable range of possible future growth.

3.4 WATER CONSERVATION

Population and economic growth invariably lead to increased demands for water resources and for investment capital needed to develop the resource for use. There is an opportunity to significantly reduce demands through conservation strategies specifically aimed at new residential and commercial development. These opportunities arise from the ability to incorporate improved water use efficiency into the planning, design and construction of the new development. In addition to conservation strategies aimed at new development, other programs to improve water use efficiency include:

- o the adoption of utility rate programs that reflect the true cost of water and that promote conservation;
- o a continuing customer information program that informs citizens of the need and how to conserve water;
- o implementation of a strategy for gradual replacement of wasteful water fixtures through a retrofitting program; and
- o load management techniques, including rules on outside watering.

All of these techniques are applicable, and should be more fully considered during the implementation phase of this project.

The potential benefits of water conservation are substantial. Reduced water use resulting from conservation measures can potentially reduce utility costs by allowing for more optimal sizing of water facilities and by favorably impacting the timing and sizing of future facility expansions.

VII. Leak Detection and Repair

A. Continue leak detection and repair programs and utilize water audits to compare production and delivery of water.

VIII. Recycling and Reuse

A. The study participants should continue to investigate and implement methods to reuse treated wastewater.

IX. Implementation and Enforcement

A. The regional agency will provide overall guidance and assistance to its customers in the implementation of the Plan, provide public education/information services to its customers and be responsible for submission of an annual report to TWDB concerning implementation of the Plan.

B. The participating entities shall adopt ordinances or resolutions for the implementation and enforcement of the Plan and report implementation activities to the regional agency.

An effective conservation program is a high-priority objective of this plan. Because it is the intention of the regional system to practice water conservation, the per capita usage projections indicate a leveling-off. This is discussed further in the following section.

3.5 PER CAPITA WATER USAGE

Per capita water usage is the total water volume flow for a specific area divided by the population in that area. Typical units are gallons per capita per day (gpcd). When applied to population projections, per capita statistics yield average water demands that include residential and non-residential water use.

Factors such as climate, season, level of affluence, population per household, plumbing and building codes, as well as the general character of land use, contribute to the average level of per capita water usage. These figures can vary considerably from entity to entity, and from year to year. In an effort to better determine the average per capita water usage for participating entities, the Study Team reviewed historical and existing water usage data, information from previous studies and usage projections developed by the TWDB. These per capita usage statistics, as well as the study projections, are presented in Table 3-3.

The initial surveys and interviews with the study participants resulted in information regarding water usage. Several rural participants currently using ground water indicated low water usage due to problems of taste and quality, and usage characteristics of a general rural setting. Many of their customers use bottled water. Consequently, conversion to surface water, with its improved taste and quality, would alleviate the need for bottled water and will likely increase per capita usage to more generally recognized levels.

Information obtained from the participants, as well as projections developed by the TWDB, were the basis of per capita usage projections developed for this study. In most cases, 1990 projections were based on information provided by the participant or based on the TWDB Low Scenario. If an entity indicated low usage due to poor water quality, projections were adjusted. In addition, participants with no available projections (such as some of the small water supply corporations) were assigned the same per capita usage as participants with similar characteristics.

Per capita projections will generally increase as economic development occurs. However, this increase will be diminished as water conservation programs are implemented. Therefore, per capita projections beyond the year 1990 developed for use in this study only indicate a marginal increase. This increase corresponds with the per capita growth of the TWDB projections.

The Study Team projections shown in Table 3-3 were used for developing water demand. There is a wide variation of gallons-per-capita-per-day levels among the study

TABLE 3-3

PER CAPITA USAGE STATISTICS

(gpcd)

Entity/Source	1980	1987	1990	2000	2010	2020	2030
Ennis							
City	155	--	170	180	190	--	--
TWDB (low)	145	--	116	119	119	119	119
TWDB (high)	145	--	173	178	177	177	178
Study	145	163	170	178	177	177	178
Ferris							
City	119	--	125	--	--	--	--
TWDB (low)	119	--	124	127	127	126	127
TWDB (high)	119	--	182	185	185	184	184
Study	119	123	125	128	128	128	128
Italy							
City	--	--	--	--	--	--	--
TWDB (low)	85	--	103	107	107	106	107
TWDB (high)	85	--	160	165	164	164	164
Study	85	103	110	115	120	125	125
Maypearl							
City	91	--	--	--	--	--	--
TWDB (low)	104	--	110	114	115	122	122
TWDB (high)	104	--	164	168	169	168	168
Study	91	97	110	115	120	125	125
Midlothian							
City	--	--	135	140	140	--	--
TWDB (low)	121	--	136	139	140	139	140
TWDB (high)	121	--	194	198	197	197	198
Study	121	132	136	140	140	140	140
Milford							
City	119	--	110	110	103	--	--
TWDB (low)	104	--	110	114	115	122	122
TWDB (high)	104	--	164	168	169	168	168
Study	104	107	110	114	115	120	125

TABLE 3-3 (Cont'd)

Entity/Source	1980	1987	1990	2000	2010	2020	2030
Palmer							
City	--	--	--	--	--	--	--
TWDB (low)	112	--	108	110	110	110	110
TWDB (high)	112	--	165	167	167	168	167
Study	105	109	111	115	115	125	125
Red Oak							
City	70	--	80	90	--	--	--
TWDB (low)	110	--	120	124	124	123	123
TWDB (high)	110	--	178	181	181	182	181
Study	110	110	110	114	115	122	125
Waxahachie							
City	192	--	196	195	195	--	--
TWDB (low)	167	--	132	137	136	137	137
TWDB (high)	167	--	190	195	194	195	195
Study	167	173	193	195	195	195	195
Wilmer							
City	72	--	70	80	90	--	--
TWDB (low)	90	--	102	106	106	106	106
TWDB (high)	90	--	159	163	164	163	163
Study	90	100	104	110	115	120	125
Boyce WSC							
Entity	60	--	68	70	70	70	70
TWDB (low)	104	--	110	115	114	115	114
TWDB (high)	104	--	164	168	169	168	168
Study	60	100	105	110	115	120	125
Bristol WSC							
Entity	76	--	--	--	--	--	--
TWDB (low)	104	--	110	115	114	115	114
TWDB (high)	104	--	164	168	169	168	168
Study	100	101	105	110	115	120	125

TABLE 3-3 (Concluded)

Entity/Source	1980	1987	1990	2000	2010	2020	2030
Buena Vista WSC							
Entity	104	--	--	--	--	--	--
TWDB (low)	104	--	110	115	114	115	114
TWDB (high)	104	--	164	168	169	168	168
Study	100	101	105	110	115	120	125
East Garrett WSC							
Entity	--	120	--	--	--	--	--
TWDB (low)	104	--	110	115	114	115	114
TWDB (high)	104	--	164	168	169	168	168
Study	104	120	122	126	128	128	128
Rockett WSC							
Entity	--	--	--	--	--	--	--
TWDB (low)	104	--	110	115	114	115	114
TWDB (high)	104	--	164	168	169	168	168
Study	104	111	114	115	117	122	125

participants. This reflects the individual characteristics of each community. As indicated, the per capita usage should experience a gradual increase over the planning period due to expected economic development, dampened to some degree by water conservation measures. The weighted average regional per capita usage is estimated to increase from 128 gpcd in 1980 to 149 gpcd in 2030 ("with SSC" scenario).

3.6 AVERAGE WATER DEMAND PROJECTIONS

Using the adopted population and per capita water usage components, the Study Team projected average demand for the Ellis County Water System to the year 2030. The "with SSC" projections for each participant, as well as the projections for the Study Area, are presented in Table 3-4. The "without SSC" projections are presented in Table 3-5. Distribution of 1980 and 2030 demands is illustrated in Figures 3-2, 3-3 and 3-4. The average demand for the Study Area in 1980 was estimated to be 7.93 MGD, and is projected to increase to 41.08 MGD by 2030 ("with SSC" high scenario). Based on information received from the Texas National Research Laboratory Commission Superconducting Super Collider Dallas-Fort Worth, the anticipated demand for surface water for the SSC is expected to be 1.58 MGD.

3.7 PEAK DAY DEMAND

Water demand in a community varies seasonally. In mid-winter, the average daily use is usually lower than the annual daily average, while in the summer it may be above the average because of lawn irrigation needs. For most communities, the maximum daily use will be about 200 percent of the average daily use throughout the year, which results in the peaking factor of 2.0 times average daily use. Consequently, peak demands were estimated using a peaking factor of 2.0. This factor represents the ratio of peak day and average day demand. Peak demands were calculated by multiplying the average daily demands (High Scenario) shown in Table 3-4 by the entity's unique peaking factor. Peak day water demands are shown in Table 3-6(A). Table 3-6(B) shows the development of each entity's peak rate.

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TABLE 3-4
POPULATION & AVERAGE WATER DEMAND PROJECTIONS
(W/SSC)

ENTITY		1980	1987	1990	2000	2010	2020	2030
ENNIS								
	POPULATION (L)	12,110	13,650	16,000	22,807	27,322	31,113	35,736
	POPULATION (H)	12,110	13,650	16,000	22,807	29,756	37,353	45,088
	GPCD	145	163	170	178	177	177	178
	DEMAND (MGD)-L	1.76	2.22	2.72	4.06	4.84	5.51	6.36
	DEMAND (MGD)-H	1.76	2.22	2.72	4.06	5.27	6.61	8.03
FERRIS								
	POPULATION (L)	2,228	2,525	2,791	3,485	4,306	4,770	5,313
	POPULATION (H)	2,228	2,525	2,791	3,485	4,306	5,022	5,593
	GPCD	119	123	125	128	128	128	128
	DEMAND (MGD)-L	0.27	0.31	0.35	0.45	0.55	0.61	0.68
	DEMAND (MGD)-H	0.27	0.31	0.35	0.45	0.55	0.64	0.72
ITALY								
	POPULATION (L)	1,306	1,650	1,899	2,776	3,803	4,761	5,918
	POPULATION (H)	1,306	1,650	1,899	2,776	3,803	5,012	6,230
	GPCD	85	103	110	115	120	125	125
	DEMAND (MGD)-L	0.11	0.17	0.21	0.32	0.46	0.60	0.74
	DEMAND (MGD)-H	0.11	0.17	0.21	0.32	0.46	0.63	0.78
MAYPEARL								
	POPULATION (L)	626	729	911	1,332	1,825	2,285	2,839
	POPULATION (H)	626	729	911	1,332	1,825	2,405	2,989
	GPCD	91	97	110	115	120	125	125
	DEMAND (MGD)-L	0.06	0.07	0.10	0.15	0.22	0.29	0.35
	DEMAND (MGD)-H	0.06	0.07	0.10	0.15	0.22	0.30	0.37
MIDLOTHIAN								
	POPULATION (L)	3,219	4,350	7,135	10,975	16,246	21,770	27,400
	POPULATION (H)	3,219	4,350	7,135	10,975	16,246	22,916	30,547
	GPCD	121	132	136	140	140	140	140
	DEMAND (MGD)-L	0.39	0.57	0.97	1.54	2.27	3.05	3.84
	DEMAND (MGD)-H	0.39	0.57	0.97	1.54	2.27	3.21	4.28
MILFORD								
	POPULATION (L)	681	710	990	1,447	1,982	2,418	3,083
	POPULATION (H)	681	710	990	1,447	1,982	2,612	3,246
	GPCD	104	107	110	114	115	120	125
	DEMAND (MGD)-L	0.07	0.08	0.11	0.16	0.23	0.29	0.39
	DEMAND (MGD)-H	0.07	0.08	0.11	0.16	0.23	0.31	0.41

TABLE 3-4
POPULATION & AVERAGE WATER DEMAND PROJECTIONS
(W/SSC)

ENTITY		1980	1987	1990	2000	2010	2020	2030
PALMER								
	POPULATION (L)	1,187	1,550	2,066	2,658	3,284	3,639	4,052
	POPULATION (H)	1,187	1,550	2,066	2,658	3,284	3,830	4,266
	GPCD	105	109	111	115	115	125	125
	DEMAND (MGD)-L	0.12	0.17	0.23	0.31	0.38	0.45	0.51
	DEMAND (MGD)-H	0.12	0.17	0.23	0.31	0.38	0.48	0.53
RED OAK								
	POPULATION (L)	1,882	2,425	3,568	6,095	9,465	10,985	12,400
	POPULATION (H)	1,882	2,425	3,568	6,095	9,465	13,351	17,943
	GPCD	110	110	110	114	115	122	125
	DEMAND (MGD)-L	0.21	0.27	0.39	0.69	1.09	1.34	1.55
	DEMAND (MGD)-H	0.21	0.27	0.39	0.69	1.09	1.63	2.24
WAXAHACHIE								
	POPULATION (L)	14,624	18,550	21,448	28,352	34,560	40,306	44,828
	POPULATION (H)	14,624	18,550	21,448	28,352	35,038	41,676	47,188
	GPCD	167	173	193	195	195	195	195
	DEMAND (MGD)-L	2.44	3.21	4.14	5.53	6.74	7.86	8.74
	DEMAND (MGD)-H	2.44	3.21	4.14	5.53	6.83	8.13	9.20
WILMER								
	POPULATION (L)	2,367	3,154	3,504	4,672	5,656	6,199	6,867
	POPULATION (H)	2,367	3,154	3,504	4,672	5,656	6,525	7,229
	GPCD	90	100	104	110	115	120	125
	DEMAND (MGD)-L	0.21	0.32	0.36	0.51	0.65	0.74	0.86
	DEMAND (MGD)-H	0.21	0.32	0.36	0.51	0.65	0.78	0.90
BOYCE WSC								
	POPULATION (L)	900	1,022	1,163	1,653	2,001	2,194	2,430
	POPULATION (H)	900	1,022	1,163	1,653	2,001	2,309	2,558
	GPCD	60	100	105	110	115	120	125
	DEMAND (MGD)-L	0.05	0.10	0.12	0.18	0.23	0.26	0.30
	DEMAND (MGD)-H	0.05	0.10	0.12	0.18	0.23	0.28	0.32
BRISTOL WSC								
	POPULATION (L)	594	675	768	1,092	1,322	1,449	1,605
	POPULATION (H)	594	675	768	1,092	1,322	1,525	1,690
	GPCD	100	101	105	110	115	120	125
	DEMAND (MGD)-L	0.06	0.07	0.08	0.12	0.15	0.17	0.20
	DEMAND (MGD)-H	0.06	0.07	0.08	0.12	0.15	0.18	0.21

TABLE 3-4
POPULATION & AVERAGE WATER DEMAND PROJECTIONS
(W/SSC)

ENTITY	1980	1987	1990	2000	2010	2020	2030
BUENA VISTA WSC							
POPULATION (L)	1,424	1,617	2,070	3,026	4,146	5,192	6,454
POPULATION (H)	1,424	1,617	2,070	3,026	4,146	5,465	6,794
GPCD	100	101	105	110	115	120	125
DEMAND (MGD)-L	0.14	0.16	0.22	0.33	0.48	0.62	0.81
DEMAND (MGD)-H	0.14	0.16	0.22	0.33	0.48	0.66	0.85
EAST GARRETT WSC							
POPULATION (L)	671	762	867	1,232	1,492	1,635	1,811
POPULATION (H)	671	762	867	1,232	1,492	1,721	1,907
GPCD	104	120	122	126	128	128	128
DEMAND (MGD)-L	0.07	0.09	0.11	0.16	0.19	0.21	0.23
DEMAND (MGD)-H	0.07	0.09	0.11	0.16	0.19	0.22	0.24
ROCKETT WSC							
POPULATION (L)	7,263	15,036	20,073	28,534	33,940	38,240	41,953
POPULATION (H)	7,263	15,036	20,073	28,534	34,544	39,853	44,153
GPCD	104	111	114	115	117	122	125
DEMAND (MGD)-L	0.76	1.67	2.29	3.28	3.97	4.67	5.24
DEMAND (MGD)-H	0.76	1.67	2.29	3.28	4.04	4.86	5.52
OTHER CITIES							
POPULATION (L)	2,552	2,924	3,430	4,890	6,296	7,442	8,382
POPULATION (H)	2,552	2,924	3,430	4,890	6,296	7,834	9,382
GPCD	129	135	137	140	145	147	151
DEMAND (MGD)-L	0.33	0.39	0.47	0.68	0.91	1.09	1.27
DEMAND (MGD)-H	0.33	0.39	0.47	0.68	0.91	1.15	1.42
OTHER RURAL AREAS							
POPULATION (L)	8,476	9,293	9,999	15,299	21,580	24,149	26,447
POPULATION (H)	8,476	9,293	9,999	15,299	21,580	24,509	27,839
GPCD	104	108	110	115	120	123	125
DEMAND (MGD)-L	0.88	1.00	1.10	1.76	2.59	2.97	3.31
DEMAND (MGD)-H	0.88	1.00	1.10	1.76	2.59	3.01	3.48

TABLE 3-4
POPULATION & AVERAGE WATER DEMAND PROJECTIONS
(W/SSC)

ENTITY	1980	1987	1990	2000	2010	2020	2030
STUDY AREA TOTAL							
POPULATION (L)	62,110	80,622	98,682	140,325	179,226	208,547	237,518
POPULATION (H)	62,110	80,622	98,682	140,325	182,742	223,918	264,642
GPCD	128	135	142	144	145	147	149
DEMAND (MGD)-L	7.93	10.88	13.97	20.24	25.94	30.73	35.37
DEMAND (MGD)-H	7.93	10.88	13.97	20.24	26.54	33.08	39.50
SUPERCOLLIDER							
DEMAND (MGD)			1.58	1.58	1.58	1.58	1.58
TOTAL DEMAND (MGD)							
LOW	7.93	10.88	15.55	21.82	27.52	32.31	36.95
HIGH	7.93	10.88	15.55	21.82	28.12	34.66	41.08

ITA

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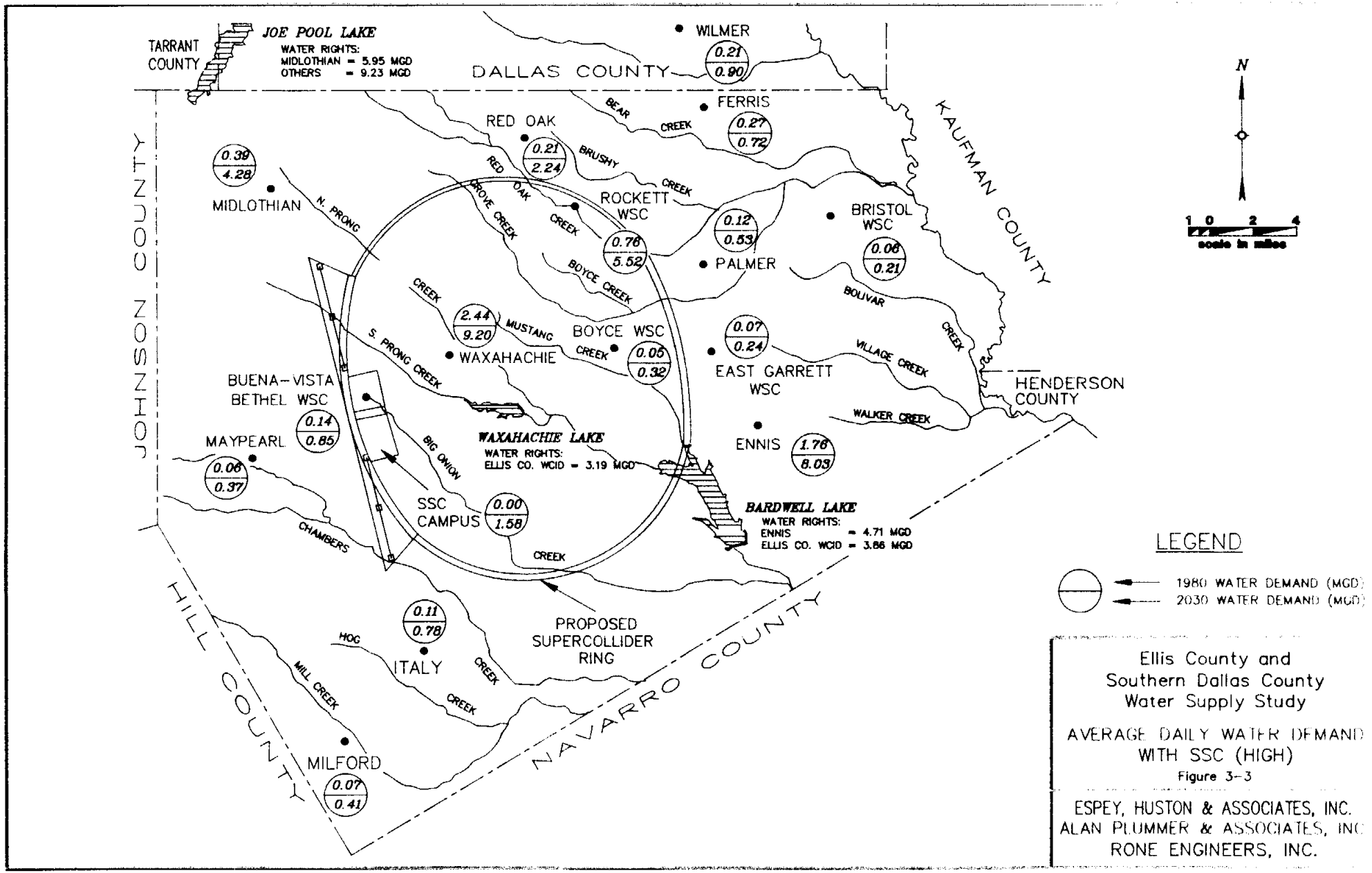


Ellis County and
Southern Dallas County
Water Supply Study

AVERAGE DAILY WATER DEMAND
WITH SSC (HIGH)

Figure 3-3

ESPEY, HUSTON & ASSOCIATES, INC.
ALAN PLUMMER & ASSOCIATES, INC.
RONE ENGINEERS, INC.

TABLE 3-4
POPULATION & AVERAGE WATER DEMAND PROJECTIONS
(W/SSC)

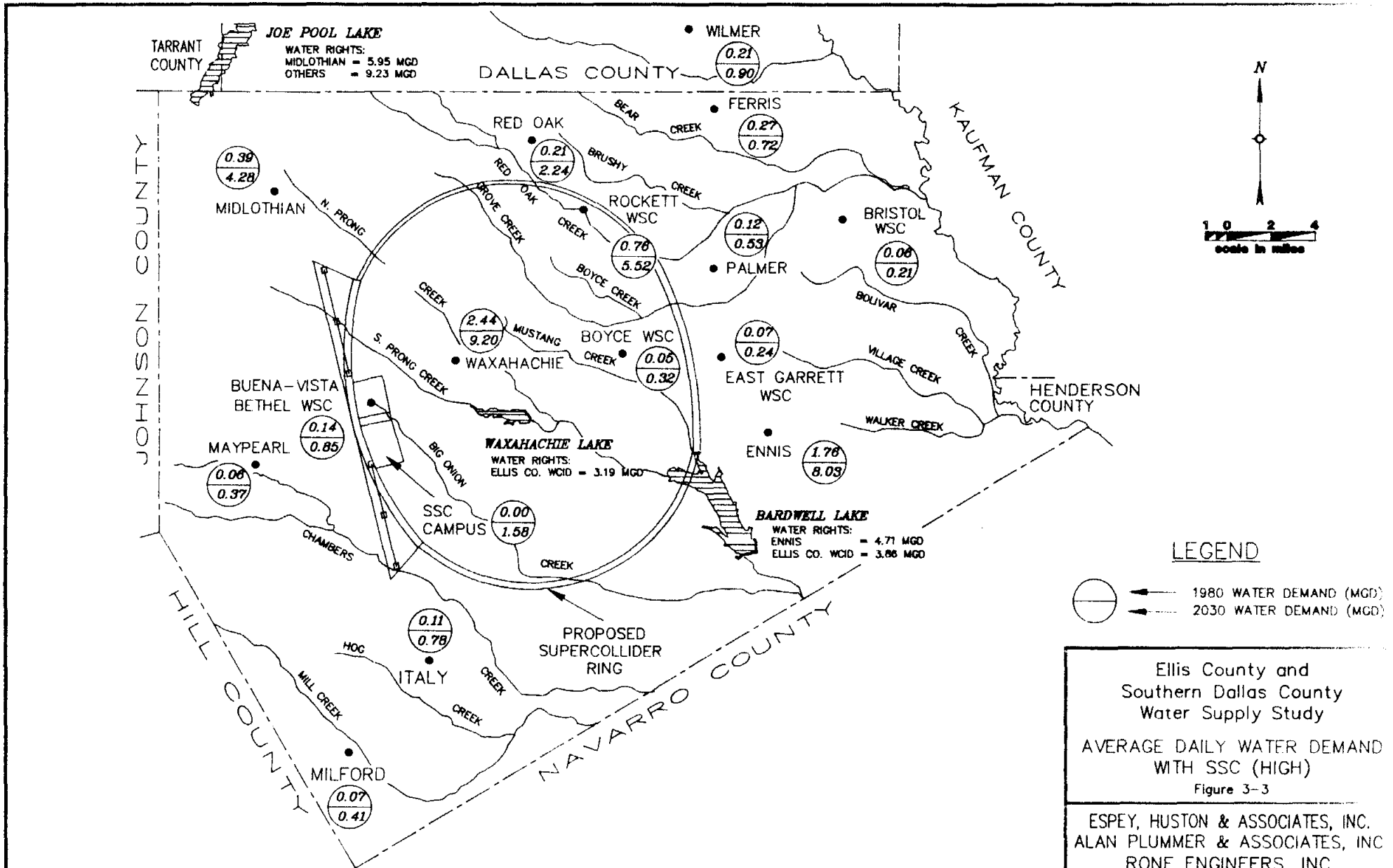
ENTITY	1980	1987	1990	2000	2010	2020	2030
STUDY AREA TOTAL							
POPULATION (L)	62,110	80,622	98,682	140,325	179,226	208,547	237,518
POPULATION (H)	62,110	80,622	98,682	140,325	182,742	223,918	264,642
GPCD	128	135	142	144	145	147	149
DEMAND (MGD)-L	7.93	10.88	13.97	20.24	25.94	30.73	35.37
DEMAND (MGD)-H	7.93	10.88	13.97	20.24	26.54	33.08	39.50
SUPERCOLLIDER							
DEMAND (MGD)			1.58	1.58	1.58	1.58	1.58
TOTAL DEMAND (MGD)							
LOW	7.93	10.88	15.55	21.82	27.52	32.31	36.95
HIGH	7.93	10.88	15.55	21.82	28.12	34.66	41.08

TABLE 3-5
POPULATION & AVERAGE WATER DEMAND PROJECTIONS
(W/O SSC)

ENTITY		1980	1987	1990	2000	2010	2020	2030
ENNIS								
	POPULATION	12,110	13,650	15,960	20,216	24,977	29,126	32,438
	GPCD	145	163	170	178	177	177	178
	DEMAND (MGD)	1.76	2.22	2.71	3.60	4.42	5.16	5.77
FERRIS								
	POPULATION	2,228	2,525	2,748	3,304	4,005	4,644	5,174
	GPCD	119	123	125	128	128	128	128
	DEMAND (MGD)	0.27	0.31	0.34	0.42	0.51	0.59	0.66
ITALY								
	POPULATION	1,306	1,650	1,765	2,040	2,472	2,367	3,193
	GPCD	85	103	110	115	120	125	125
	DEMAND (MGD)	0.11	0.17	0.19	0.23	0.30	0.30	0.40
MAYPEARL								
	POPULATION	626	729	750	927	1,101	1,262	1,398
	GPCD	91	97	110	115	120	125	125
	DEMAND (MGD)	0.06	0.07	0.08	0.11	0.13	0.16	0.17
MIDLOTHIAN								
	POPULATION	3,219	4,350	7,026	10,602	14,955	20,500	24,236
	GPCD	121	132	136	140	140	140	140
	DEMAND (MGD)	0.39	0.57	0.96	1.48	2.09	2.87	3.39
MILFORD								
	POPULATION	681	710	776	959	1,140	1,307	1,448
	GPCD	104	107	110	114	115	120	125
	DEMAND (MGD)	0.07	0.08	0.09	0.11	0.13	0.16	0.18
PALMER								
	POPULATION	1,187	1,550	2,034	2,520	3,054	3,542	3,946
	GPCD	105	109	111	115	115	125	125
	DEMAND (MGD)	0.12	0.17	0.23	0.29	0.35	0.44	0.49
RED OAK								
	POPULATION	1,882	2,425	3,000	4,072	5,744	7,719	8,500
	GPCD	110	110	110	114	115	122	125
	DEMAND (MGD)	0.21	0.27	0.33	0.46	0.66	0.94	1.06
WAXAHACHIE								
	POPULATION	14,624	18,550	20,305	25,387	30,122	35,482	39,780
	GPCD	167	173	193	195	195	195	195
	DEMAND (MGD)	2.44	3.21	3.92	4.95	5.87	6.92	7.76

TABLE 3-5
POPULATION & AVERAGE WATER DEMAND PROJECTIONS
(W/O SSC)

ENTITY		1980	1987	1990	2000	2010	2020	2030
WILMER								
	POPULATION	2,367	3,154	3,340	3,652	3,987	4,356	4,724
	GPCD	90	100	104	110	115	120	125
	DEMAND (MGD)	0.21	0.32	0.35	0.40	0.46	0.52	0.59
BOYCE WSC								
	POPULATION	900	1,022	1,075	1,413	1,643	1,871	2,075
	GPCD	60	100	105	110	115	120	125
	DEMAND (MGD)	0.05	0.10	0.11	0.16	0.19	0.22	0.26
BRISTOL WSC								
	POPULATION	594	675	709	932	1,084	1,235	1,370
	GPCD	100	101	105	110	115	120	125
	DEMAND (MGD)	0.06	0.07	0.07	0.10	0.12	0.15	0.17
BUENA VISTA WSC								
	POPULATION	1,424	1,617	1,700	2,234	2,598	2,959	3,282
	GPCD	100	101	105	110	115	120	125
	DEMAND (MGD)	0.14	0.16	0.18	0.25	0.30	0.36	0.41
EAST GARRETT WSC								
	POPULATION	671	762	801	1,053	1,224	1,394	1,546
	GPCD	104	120	122	126	128	128	128
	DEMAND (MGD)	0.07	0.09	0.10	0.13	0.16	0.18	0.20
ROCKETT WSC								
	POPULATION	7,263	15,036	18,510	24,325	28,285	32,216	35,727
	GPCD	104	111	114	115	117	122	125
	DEMAND (MGD)	0.76	1.67	2.11	2.80	3.31	3.77	4.36
OTHER CITIES								
	POPULATION	2,552	2,924	3,083	3,997	4,773	5,426	6,260
	GPCD	129	135	137	140	145	147	151
	DEMAND (MGD)	0.33	0.39	0.42	0.56	0.69	0.80	0.95
OTHER RURAL AREAS								
	POPULATION	8,476	9,293	9,643	14,378	20,954	23,789	26,193
	GPCD	104	108	110	115	120	123	125
	DEMAND (MGD)	0.88	1.00	1.06	1.65	2.51	2.93	3.27
STUDY AREA TOTAL								
	POPULATION	62,110	80,622	93,225	122,011	152,118	179,195	201,290
	AVG. GPCD	128	135	142	145	146	148	150
	DEMAND (MGD)	7.93	10.88	13.25	17.71	22.22	26.46	30.10

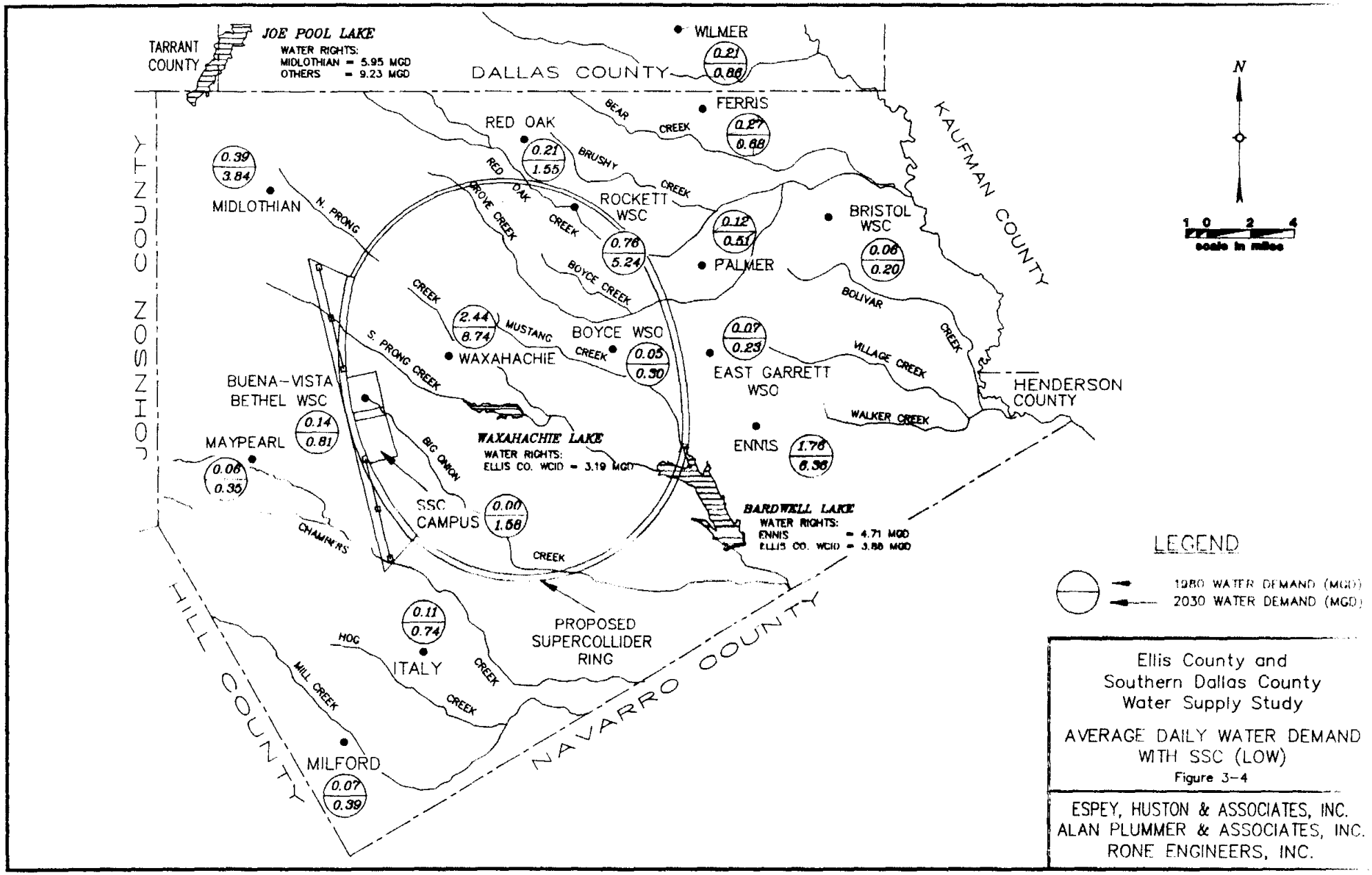


Ellis County and
Southern Dallas County
Water Supply Study

AVERAGE DAILY WATER DEMAND
WITH SSC (HIGH)

Figure 3-3

ESPEY, HUSTON & ASSOCIATES, INC.
ALAN PLUMMER & ASSOCIATES, INC
RONE ENGINEERS, INC.


TARRANT COUNTY
JOE POOL LAKE
WATER RIGHTS:
MIDLOTHIAN = 5.95 MGD
OTHERS = 9.23 MGD
DALLAS COUNTY
WILMER
0.21
0.86
FERRIS
0.27
0.68
KAUFMAN COUNTY
RED OAK
0.21
1.55
BEAR CREEK
BRUSHY CREEK
RED OAK CREEK
GROVE CREEK
0.39
3.84
MIDLOTHIAN
N. PRONG
ROCKETT WSC
0.76
5.24
BOYCE CREEK
BRISTOL WSC
0.12
0.51
PALMER
0.06
0.20
BOLIVAR CREEK
2.44
8.74
MUSTANG CREEK
BOYCE WSO
0.05
0.30
WAXAHACHIE
S. PRONG CREEK
0.07
0.23
EAST GARRETT WSO
VILLAGE CREEK
HENDERSON COUNTY
JOHNSON COUNTY
BUENA-VISTA BETHEL WSC
0.14
0.81
WALKER CREEK
MAYPEARL
0.08
0.36
WAXAHACHIE LAKE
WATER RIGHTS:
ELLIS CO. WCID = 3.19 MGD
ENNIS
1.76
6.36
BIG ONION
SSC CAMPUS
0.00
1.58
BARDWELL LAKE
WATER RIGHTS:
ENNIS = 4.71 MGD
ELLIS CO. WCID = 3.88 MGD
CHAMBERS CREEK
0.11
0.74
HOG CREEK
PROPOSED SUPERCOLLIDER RING
ITALY
MILL CREEK
HILL COUNTY
NAVARRO COUNTY
MILFORD
0.07
0.39
N
1 0 2 4
scale in miles
LEGEND
1980 WATER DEMAND (MGD)
2030 WATER DEMAND (MGD)
Ellis County and
Southern Dallas County
Water Supply Study
AVERAGE DAILY WATER DEMAND
WITH SSC (LOW)
Figure 3-4
ESPEY, HUSTON & ASSOCIATES, INC.
ALAN PLUMMER & ASSOCIATES, INC.
RONE ENGINEERS, INC.

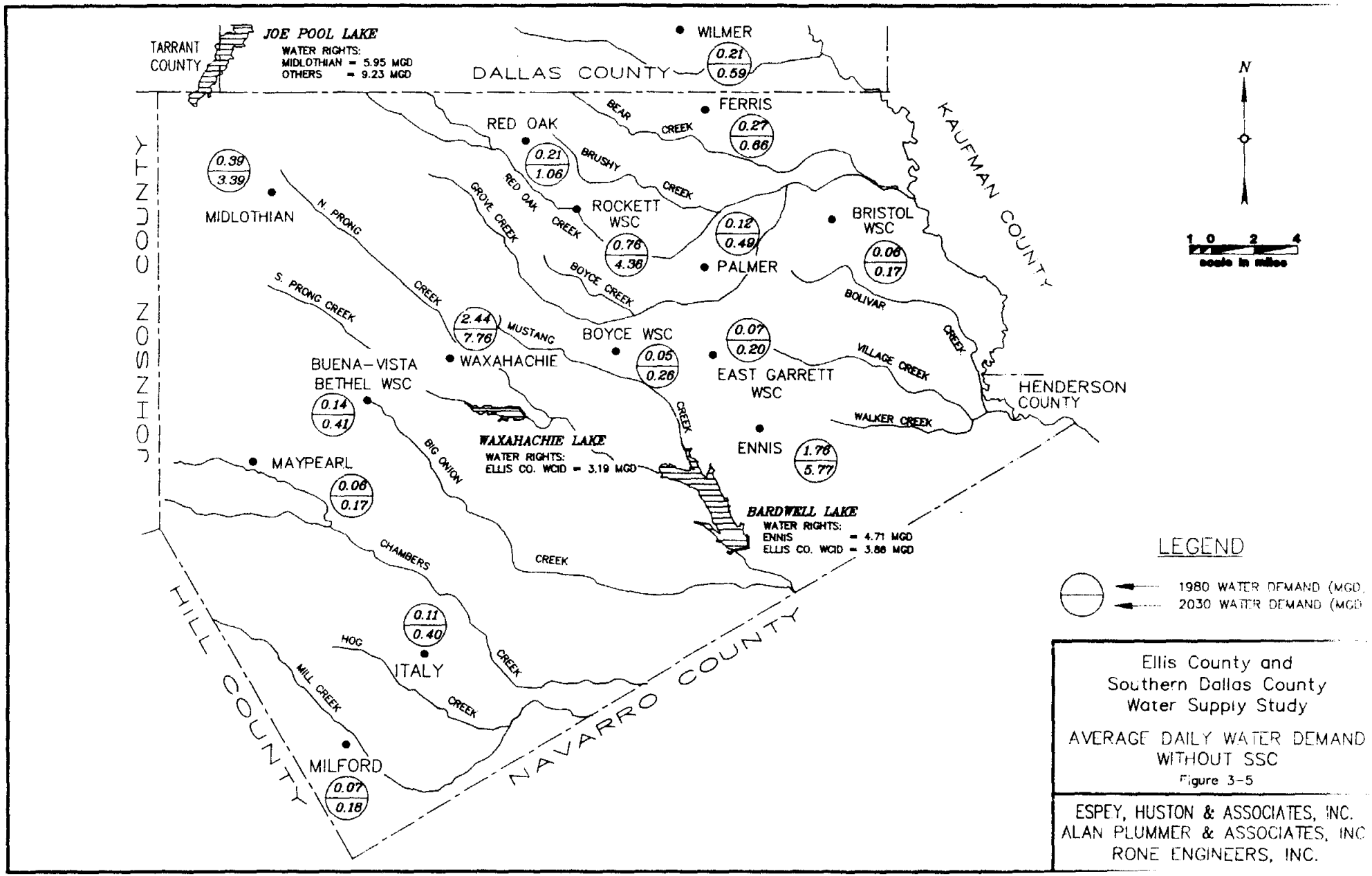

JOE POOL LAKE
WATER RIGHTS:
MIDLOTHIAN = 5.95 MGD
OTHERS = 9.23 MGD
TARRANT COUNTY
DALLAS COUNTY
WILMER
0.21
0.59
FERRIS
0.27
0.66
RED OAK
0.21
1.06
BEAR CREEK
BRUSHY CREEK
RED OAK CREEK
GROVE CREEK
ROCKETT WSC
0.76
4.36
0.12
0.49
BRISTOL WSC
0.06
0.17
PALMER
BOYCE CREEK
BOLIVAR CREEK
KAUFMAN COUNTY
0.39
3.39
MIDLOTHIAN
N. PRONG CREEK
S. PRONG CREEK
2.44
7.76
MUSTANG CREEK
BOYCE WSC
0.05
0.26
0.07
0.20
EAST GARRETT WSC
VILLAGE CREEK
WALKER CREEK
HENDERSON COUNTY
BUENA-VISTA BETHEL WSC
0.14
0.41
WAXAHACHIE
WAXAHACHIE LAKE
WATER RIGHTS:
ELLIS CO. WCID = 3.19 MGD
ENNIS
1.76
5.77
BIG ONION CREEK
MAYPEARL
0.06
0.17
BARDWELL LAKE
WATER RIGHTS:
ENNIS = 4.71 MGD
ELLIS CO. WCID = 3.88 MGD
CHAMBERS CREEK
JOHNSON COUNTY
HILL COUNTY
NAVARRO COUNTY
0.11
0.40
ITALY
HOG CREEK
MILL CREEK
MILFORD
0.07
0.18
N
1 0 2 4
scale in miles
LEGEND
1980 WATER DEMAND (MGD)
2030 WATER DEMAND (MGD)
Ellis County and
Southern Dallas County
Water Supply Study
AVERAGE DAILY WATER DEMAND
WITHOUT SSC
Figure 3-5
ESPEY, HUSTON & ASSOCIATES, INC.
ALAN PLUMMER & ASSOCIATES, INC
RONE ENGINEERS, INC.

TABLE 3-6(A)
PEAK WATER DEMAND PROJECTIONS
(MGD)

ENTITY	1980	1987	1990	2000	2010	2020	2030
ENNIS							
1.84 W/SSC (HIGH)	3.23	4.09	5.00	7.47	9.69	12.17	14.77
W/SSC (LOW)	3.23	4.09	5.00	7.47	8.90	10.13	11.70
W/O SSC	3.23	4.09	4.99	6.62	8.13	9.49	10.62
FERRIS							
2.19 W/SSC (HIGH)	0.58	0.68	0.76	0.98	1.21	1.41	1.57
W/SSC (LOW)	0.58	0.68	0.76	0.98	1.21	1.34	1.49
W/O SSC	0.58	0.68	0.75	0.93	1.12	1.30	1.45
ITALY							
2.00 W/SSC (HIGH)	0.22	0.34	0.42	0.64	0.91	1.25	1.56
W/SSC (LOW)	0.22	0.34	0.42	0.64	0.91	1.19	1.48
W/O SSC	0.22	0.34	0.39	0.47	0.59	0.59	0.80
MAYPEARL							
2.00 W/SSC (HIGH)	0.11	0.14	0.20	0.31	0.44	0.60	0.75
W/SSC (LOW)	0.11	0.14	0.20	0.31	0.44	0.57	0.71
W/O SSC	0.11	0.14	0.17	0.21	0.26	0.32	0.35
MIDLOTHIAN							
2.2 W/SSC (HIGH)	0.86	1.26	2.13	3.38	5.00	7.06	9.41
W/SSC (LOW)	0.86	1.26	2.13	3.38	5.00	6.71	8.44
W/O SSC	0.86	1.26	2.10	3.27	4.61	6.31	7.46
MILFORD							
1.49 W/SSC (HIGH)	0.11	0.11	0.16	0.25	0.34	0.47	0.60
W/SSC (LOW)	0.11	0.11	0.16	0.25	0.34	0.43	0.57
W/O SSC	0.11	0.11	0.13	0.16	0.20	0.23	0.27
PALMER							
2.00 W/SSC (HIGH)	0.25	0.34	0.46	0.61	0.76	0.96	1.07
W/SSC (LOW)	0.25	0.34	0.46	0.61	0.76	0.91	1.01
W/O SSC	0.25	0.34	0.45	0.58	0.70	0.89	0.99
RED OAK							
2.00 W/SSC (HIGH)	0.41	0.53	0.78	1.39	2.18	3.26	4.49
W/SSC (LOW)	0.41	0.53	0.78	1.39	2.18	2.68	3.10
W/O SSC	0.41	0.53	0.66	0.93	1.32	1.88	2.13
WAXAHACHIE							
2.26 W/SSC (HIGH)	5.52	7.25	9.36	12.49	15.44	18.37	20.80
W/SSC (LOW)	5.52	7.25	9.36	12.49	15.23	17.76	19.76
W/O SSC	5.52	7.25	8.86	11.19	13.27	15.64	17.53

TABLE 3-6(A)
PEAK WATER DEMAND PROJECTIONS
(MGD)

ENTITY	1980	1987	1990	2000	2010	2020	2030
WILMER							
2.42 W/SSC (HIGH)	0.52	0.76	0.88	1.24	1.57	1.89	2.19
W/SSC (LOW)	0.52	0.76	0.88	1.24	1.57	1.80	2.08
W/O SSC	0.52	0.76	0.84	0.97	1.11	1.26	1.43
BOYCE WSC							
1.2 W/SSC (HIGH)	0.06	0.12	0.15	0.22	0.28	0.33	0.38
W/SSC (LOW)	0.06	0.12	0.15	0.22	0.28	0.32	0.36
W/O SSC	0.06	0.12	0.14	0.19	0.23	0.27	0.31
BRISTOL WSC							
1.83 W/SSC (HIGH)	0.11	0.12	0.15	0.22	0.28	0.33	0.39
W/SSC (LOW)	0.11	0.12	0.15	0.22	0.28	0.32	0.37
W/O SSC	0.11	0.12	0.14	0.19	0.23	0.27	0.31
BUENA VISTA WSC							
1.21 W/SSC (HIGH)	0.17	0.20	0.26	0.40	0.58	0.79	1.03
W/SSC (LOW)	0.17	0.20	0.26	0.40	0.58	0.75	0.98
W/O SSC	0.17	0.20	0.22	0.30	0.36	0.43	0.50
EAST GARRETT WSC							
1.58 W/SSC (HIGH)	0.11	0.14	0.17	0.25	0.30	0.35	0.39
W/SSC (LOW)	0.11	0.14	0.17	0.25	0.30	0.33	0.37
W/O SSC	0.11	0.14	0.15	0.21	0.25	0.28	0.31
ROCKETT WSC							
3.13 W/SSC (HIGH)	2.36	5.22	7.16	10.27	12.65	15.22	17.27
W/SSC (LOW)	2.36	5.22	7.16	10.27	12.43	14.60	16.41
W/O SSC	2.36	5.22	6.60	8.76	10.36	11.80	13.64
OTHER CITIES							
2.00 W/SSC (HIGH)	0.66	0.79	0.94	1.37	1.83	2.30	2.83
W/SSC (LOW)	0.66	0.79	0.94	1.37	1.83	2.19	2.53
W/O SSC	0.66	0.79	0.84	1.12	1.38	1.60	1.89
OTHER RURAL AREAS							
2.00 W/SSC (HIGH)	1.76	2.01	2.20	3.52	5.18	6.03	6.96
W/SSC (LOW)	1.76	2.01	2.20	3.52	5.18	5.94	6.61
W/O SSC	1.76	2.01	2.12	3.31	5.03	5.85	6.55

TABLE 3-6(B)
PEAK FACTOR CALCULATION

ENTITIES	ADF	PEAK FACTOR	PDF	SOURCE
ENNIS	2.22	1.84	4.09	BLACK & VEATCH
FERRIS	0.31	2.19	0.68	QUESTIONNAIRE
ITALY	0.17	2.00	0.34	DEFAULT
MAYPEARL	0.07	2.00	0.14	DEFAULT
MIDLOTHIAN	0.57	2.20	1.26	QUESTIONNAIRE
MILFORD	0.08	1.49	0.11	QUESTIONNAIRE
PALMER	0.17	2.00	0.34	DEFAULT
RED OAK	0.27	2.00	0.53	DEFAULT
WAXAHACHIE	3.21	2.26	7.25	QUESTIONNAIRE
WILMER	0.32	2.42	0.76	QUESTIONNAIRE
BOYCE WSC	0.10	1.20	0.12	QUESTIONNAIRE
BRISTOL WSC	0.07	1.83	0.12	QUESTIONNAIRE
BUENA VISTA BETHEL WSC	0.16	1.21	0.20	QUESTIONNAIRE
EAST GARRETT WSC	0.09	1.58	0.14	QUESTIONNAIRE
ROCKETT WSC	1.67	3.13	5.22	JERRY LANDS
TOTAL	9.48	2.25	21.33	

ADF = Annual Average Daily Flow

PDF = Peak Daily Flow

Peak Factor = PDF/ADF

Some communities may experience unusual peaking conditions for a variety of reasons, which include:

- o inadequate storage;
- o relatively inexpensive water, which encourages liberal usage;
- o lack of water conservation program.

Implicit in the preparation of this report is that the regional system will have the capability to deliver 2.0 times Average Daily Water Requirements. This may require customer entities to review those factors which contribute to abnormal peaking conditions or purchase additional water to satisfy peak demands.

3.8 WATER DEFICIT

In order to estimate the water supply needed to serve the Study Area, the Study Team analyzed the existing supply with respect to future demand. A summary of the existing water supply source for the participating agencies is presented below. This information was obtained from questionnaires, interviews and engineering reports. The information is summarized in Table 3-7.

Boyce Water Supply Corporation. This system provides water service to the 40-square mile rural area between Ennis and Waxahachie. Its present water supply consists of three wells with a total capacity of 42,500 gallons per day (0.04 MGD). Based on demand projections (With SSC High Scenario) developed in this study, Boyce WSC will need to increase its supply capacity in order to satisfy 1990 requirements. Boyce WSC indicated it will replace its ground-water with surface water when it becomes available; therefore, it is necessary to plan for new surface water for this entity.

Bristol Water Supply Corporation. The Bristol WSC provides water service to 15 square miles of rural area in the eastern portion of Ellis County. Its present water supply consists of two wells with a total capacity of 0.30 MGD. Based on demand projections (With SSC

TABLE 3-7

EXISTING WATER SUPPLY

Entity	Surface Water (MGD)[1]	Ground Water (MGD)	Current Plans
Boyce WSC	--	0.0425	Replace ground water
Bristol WSC	--	0.3000	Replace ground water
Buena Vista WSC	--	0.7200	Replace ground water
East Garrett WSC	--	0.0000	Purchases treated water from Ennis
Ennis	4.71	0.0000	Supplement existing supply
Ferris	--	0.5470	Replace ground water
Italy	--	0.4390	Replace ground water
Maypearl	--	0.2160	Replace ground water
Midlothian	5.95	1.4400	Existing water supply adequate
Milford	--	0.3460	Replace ground water
Palmer	--	0.4320	Supplement existing supply
Red Oak	--	0.8500	Supplement existing supply
Rockett WSC	--	5.2000	Replace ground water on an incremental basis such that by the year 2030, all needs can be met by surface water
Waxahachie	7.05	0.0000	Supplement existing supply
Wilmer	--	1.5000	Replace ground water

[1]Surface water available is based on water rights.

High Scenario), this supply would be adequate beyond the 2030 planning horizon. However, Bristol WSC plans to replace its ground water with surface water when it becomes available; therefore, it is necessary to plan for new surface water for this entity.

Buena Vista-Bethel Water Supply Corporation. This system serves the 50-square mile rural area between Waxahachie and Maypearl. Its present system consists of three wells with a total capacity of 0.72 MGD. A review of the demand projections (With SSC High Scenario) for Buena Vista indicates that the existing water supply is adequate to the year 2020. Buena Vista plans to convert to surface water.

East Garrett Water Supply Corporation. East Garrett WSC provides service to residents in the rural area northeast of Ennis. It currently buys treated water from the City of Ennis. Water requirements for East Garrett are included in the demand calculations presented for Ennis.

Ennis. The City of Ennis obtains its raw water from Bardwell Lake and provides wholesale treated water to East Garrett Water Supply Corp. and Community Water Company. In addition, they provide emergency service to Rice Water Company. Bardwell Lake has a permitted diversion of 8.57 MGD and Ennis has rights to 4.71 MGD. Based on demand calculations (With SSC High Scenario), Ennis would need to supplement this water supply by 2005, with an additional 0.13 MGD.

Ferris. The City of Ferris obtains its water supply from two wells with a total capacity of 0.55 MGD. Ferris plans to replace its ground-water usage with surface water; therefore, it is necessary to plan for surface water for this City.

Italy. The source of water for the City of Italy is two wells with a total capacity of 0.44 MGD. Italy will need to increase supply capacity by 2005. The City plans to convert to surface water.

Maypearl. The City of Maypearl obtains its water supply from three Woodbine formation wells that have a total capacity of 0.216 MGD. Although the existing supply would provide for Maypearl's needs to the year 2005, Maypearl plans to replace its ground-water usage with surface water.

Midlothian. The City of Midlothian obtains raw water from Joe Pool Lake and has rights to 5.95 MGD. This water supply should be adequate to meet the needs of Midlothian beyond the planning horizon of this study.

Milford. The City of Milford obtains its water supply from two wells having a total capacity of 0.346 MGD. It is estimated that this water supply would be adequate to the year 2020. However, Milford plans to replace ground-water usage with surface water. Therefore, it is necessary to plan for new surface water for this City.

Palmer. The source of water for the City of Palmer is two wells with a total capacity of 0.43 MGD. In addition, Palmer has a contract with Rockett WSC for emergency service. The existing water supply is expected to be adequate to the year 2015. Palmer plans to supplement its ground-water supply with surface water.

Red Oak. The City of Red Oak obtains its water supply from five wells that have a total capacity of 0.85 MGD. Red Oak plans to supplement its existing water supply. Based on demand estimates (With SSC High Scenario), Red Oak's existing supply is adequate to the year 2000.

Rockett Water Supply Corporation. The Rockett WSC serves customers in the northern part of Ellis County. Water for this system is obtained from six wells with a total capacity of 5.2 MGD. Rockett plans to phase out its usage of ground water such that by 2030, all water supply needs will be met by surface water.

Waxahachie. The City of Waxahachie obtains its water from Bardwell Lake and Waxahachie Lake. Waxahachie has rights to 3.86 MGD from Bardwell Lake and 3.19 MGD from

Waxahachie Lake; the total available supply is 7.05 MGD. It is estimated that Waxahachie will need to supplement this supply by 2015.

Wilmer. The City of Wilmer obtains its water supply from two wells with a total capacity of 1.50 MGD. Although the existing water supply would be adequate to meet the City's needs beyond the year 2030, Wilmer plans to replace its ground-water usage with surface water. As previously mentioned, the City of Wilmer is also included in the planning area for the DWU Long-Range Water Supply Study. The local high school currently obtains water from DWU.

Projections of future requirements indicate that the Study Area will need a 41.08-MGD (With SSC High Scenario) water supply to meet demands for the year 2030. In order to determine the extent of the shortfall in available resources, the gross and net surface water demand were calculated. The gross surface water demand is the overall water needs minus existing ground-water supply to be maintained. As indicated in Table 3-7, only Palmer and Red Oak plan to supplement their existing ground-water supply with surface water; Rockett WSC plans to phase out its ground-water use. The gross surface water demand is tabulated and presented in Tables 3-8, 3-9 and 3-10. Net surface water demand is the gross surface demand minus existing surface supply. Net demand projections are presented in Tables 3-11, 3-12 and 3-13. Graphs showing net surface demand for each of the participants are included at the end of this section. Surface water supply alternatives and conceptual infrastructure plans presented in Sections 4.0 and 5.0 have been developed to meet the net demands.

TABLE 3-8
GROSS SURFACE WATER DEMAND W/SSC (HIGH SCENARIO)
UNITS IN MGD

ENTITY	1990	1995	2000	2005	2010	2015	2020	2025	2030
BOYCE WSC	0.12	0.15	0.18	0.21	0.23	0.26	0.28	0.30	0.32
BRISTOL WSC	0.08	0.10	0.12	0.14	0.15	0.17	0.18	0.20	0.21
BUENA-VISTA WSC	0.22	0.28	0.33	0.41	0.48	0.57	0.66	0.76	0.85
EAST GARRETT WSC	0.11	0.14	0.16	0.18	0.19	0.21	0.22	0.23	0.24
ENNIS	2.72	3.39	4.06	4.67	5.27	5.94	6.61	7.32	8.03
FERRIS	0.35	0.40	0.45	0.50	0.55	0.60	0.64	0.68	0.72
ITALY	0.21	0.27	0.32	0.39	0.46	0.55	0.63	0.71	0.78
MAYPEARL	0.10	0.13	0.15	0.19	0.22	0.26	0.30	0.34	0.37
MIDLOTHIAN	0.97	1.26	1.54	1.91	2.27	2.74	3.21	3.75	4.28
MILFORD	0.11	0.14	0.16	0.20	0.23	0.27	0.31	0.36	0.41
PALMER	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.08	0.10
RED OAK	0.00	0.00	0.00	0.04	0.24	0.51	0.78	1.09	1.39
ROCKETT WSC	0.00	0.00	0.00	0.41	1.44	2.50	3.56	4.54	5.52
WAXAHACHIE	4.14	4.84	5.53	6.18	6.83	7.48	8.13	8.67	9.20
WILMER	0.36	0.44	0.51	0.58	0.65	0.72	0.78	0.84	0.90
SSC	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58
SUBTOTAL	11.07	13.12	15.09	17.59	20.79	24.36	27.92	31.45	34.9
CONTINGENCY -20%	2.21	2.62	3.02	3.52	4.16	4.87	5.58	6.29	6.98
TL	13.28	15.74	18.11	21.11	24.95	29.23	33.50	37.74	41.88

TABLE 3-9
GROSS SURFACE WATER DEMAND W/SSC (LOW SCENARIO)
UNITS IN MGD

ENTITY	1990	1995	2000	2005	2010	2015	2020	2025	2030
BOYCE WSC	0.12	0.15	0.18	0.21	0.23	0.25	0.26	0.28	0.30
BRISTOL WSC	0.08	0.10	0.12	0.14	0.15	0.16	0.17	0.19	0.20
BUENA-VISTA WSC	0.22	0.28	0.33	0.41	0.48	0.55	0.62	0.72	0.81
EAST GARRETT WSC	0.11	0.14	0.16	0.18	0.19	0.20	0.21	0.22	0.23
ENNIS	2.72	3.39	4.06	4.45	4.84	5.18	5.51	5.94	6.36
FERRIS	0.35	0.40	0.45	0.50	0.55	0.58	0.61	0.65	0.68
ITALY	0.21	0.27	0.32	0.39	0.46	0.53	0.60	0.67	0.74
MAYPEARL	0.10	0.13	0.15	0.19	0.22	0.26	0.29	0.32	0.35
MIDLOTHIAN	0.97	1.26	1.54	1.91	2.27	2.66	3.05	3.45	3.84
MILFORD	0.11	0.14	0.16	0.20	0.23	0.26	0.29	0.34	0.39
PALMER	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.08
RED OAK	0.00	0.00	0.00	0.04	0.24	0.37	0.49	0.60	0.70
ROCKETT WSC	0.00	0.00	0.00	0.38	1.37	2.37	3.37	4.31	5.24
WAXAHACHIE	4.14	4.84	5.53	6.14	6.74	7.30	7.86	8.30	8.74
WILMER	0.36	0.44	0.51	0.58	0.65	0.7	0.74	0.80	0.86
SSC	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58
SUBTOTAL	11.07	13.12	15.09	17.30	20.20	22.95	25.67	28.42	31.1
CONTINGENCY -20%	2.21	2.62	3.02	3.46	4.04	4.59	5.13	5.68	6.22
AL	13.28	15.74	18.11	20.76	24.24	27.54	30.80	34.10	37.32

TABLE 3-10
GROSS SURFACE WATER DEMAND W/O SSC
UNITS IN MGD

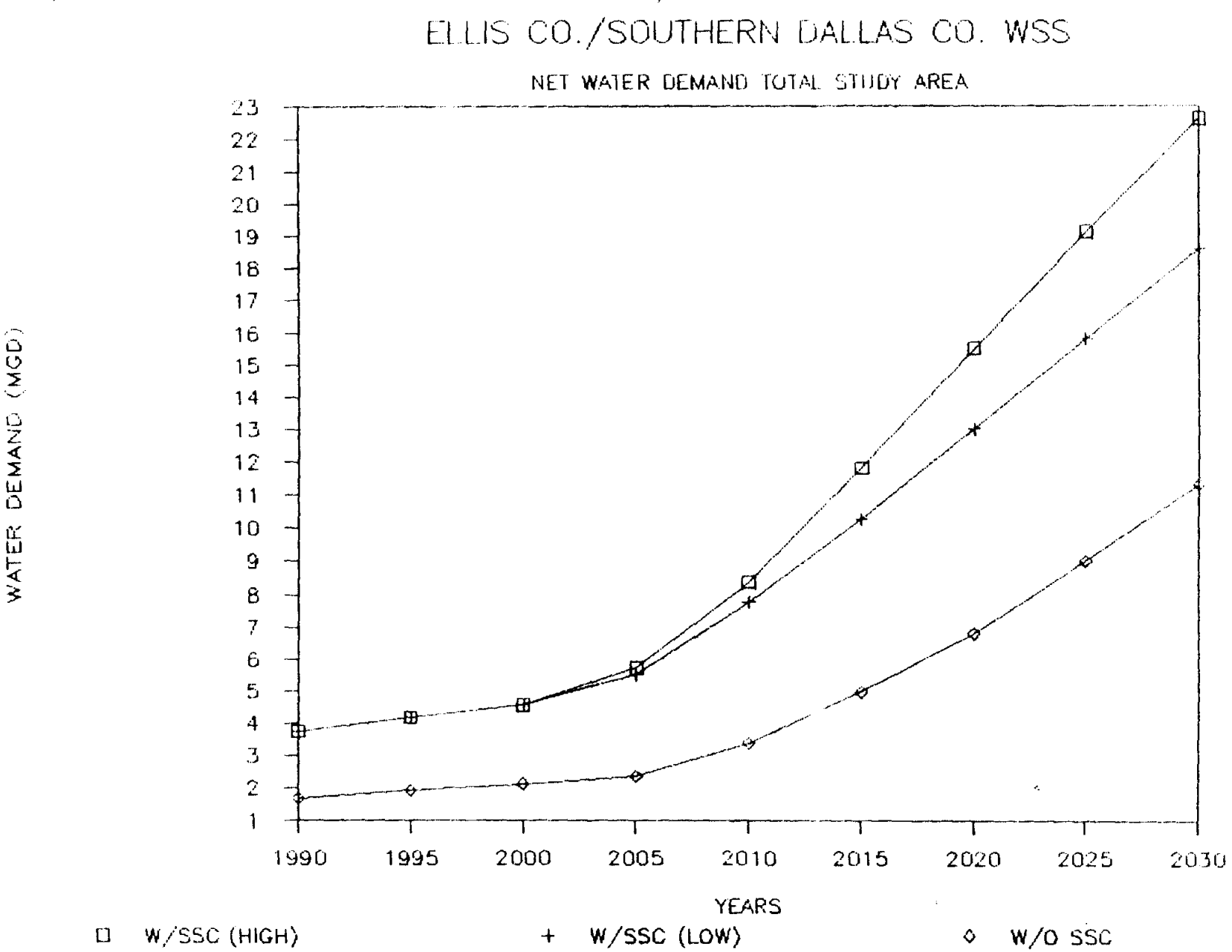
ENTITY	1990	1995	2000	2005	2010	2015	2020	2025	2030
BOYCE WSC	0.11	0.14	0.16	0.18	0.19	0.21	0.22	0.24	0.26
BRISTOL WSC	0.07	0.09	0.10	0.11	0.12	0.14	0.15	0.16	0.17
BUENA-VISTA WSC	0.18	0.22	0.25	0.28	0.30	0.33	0.36	0.39	0.41
EAST GARRETT WSC	0.10	0.12	0.13	0.15	0.16	0.17	0.18	0.19	0.20
ENNIS	2.71	3.16	3.60	4.01	4.42	4.79	5.16	5.47	5.77
FERRIS	0.34	0.38	0.42	0.47	0.51	0.55	0.59	0.63	0.66
ITALY	0.19	0.21	0.23	0.26	0.28	0.30	0.31	0.36	0.40
MAYPEARL	0.08	0.10	0.11	0.12	0.13	0.15	0.16	0.17	0.17
MIDLOTHIAN	0.96	1.22	1.48	1.79	2.09	2.48	2.87	3.13	3.39
MILFORD	0.09	0.10	0.11	0.12	0.13	0.15	0.16	0.17	0.18
PALMER	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.06
RED OAK	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.15	0.21
ROCKETT WSC	0.00	0.00	0.00	0.00	0.71	1.59	2.47	3.42	4.36
WAXAHACHIE	3.92	4.44	4.95	5.41	5.87	6.40	6.92	7.34	7.76
WILMER	0.35	0.38	0.40	0.43	0.46	0.49	0.52	0.56	0.59
SUBTOTAL	9.1	10.56	11.94	13.33	15.37	17.75	20.17	22.41	24.59
CONTINGENCY -20%	1.82	2.11	2.39	2.67	3.07	3.55	4.03	4.48	4.92
TOTAL	10.92	12.67	14.33	16.00	18.44	21.30	24.20	26.89	29.51

TABLE 3-11
NET SURFACE WATER DEMAND W/SSC (HIGH SCENARIO)
UNITS IN MGD

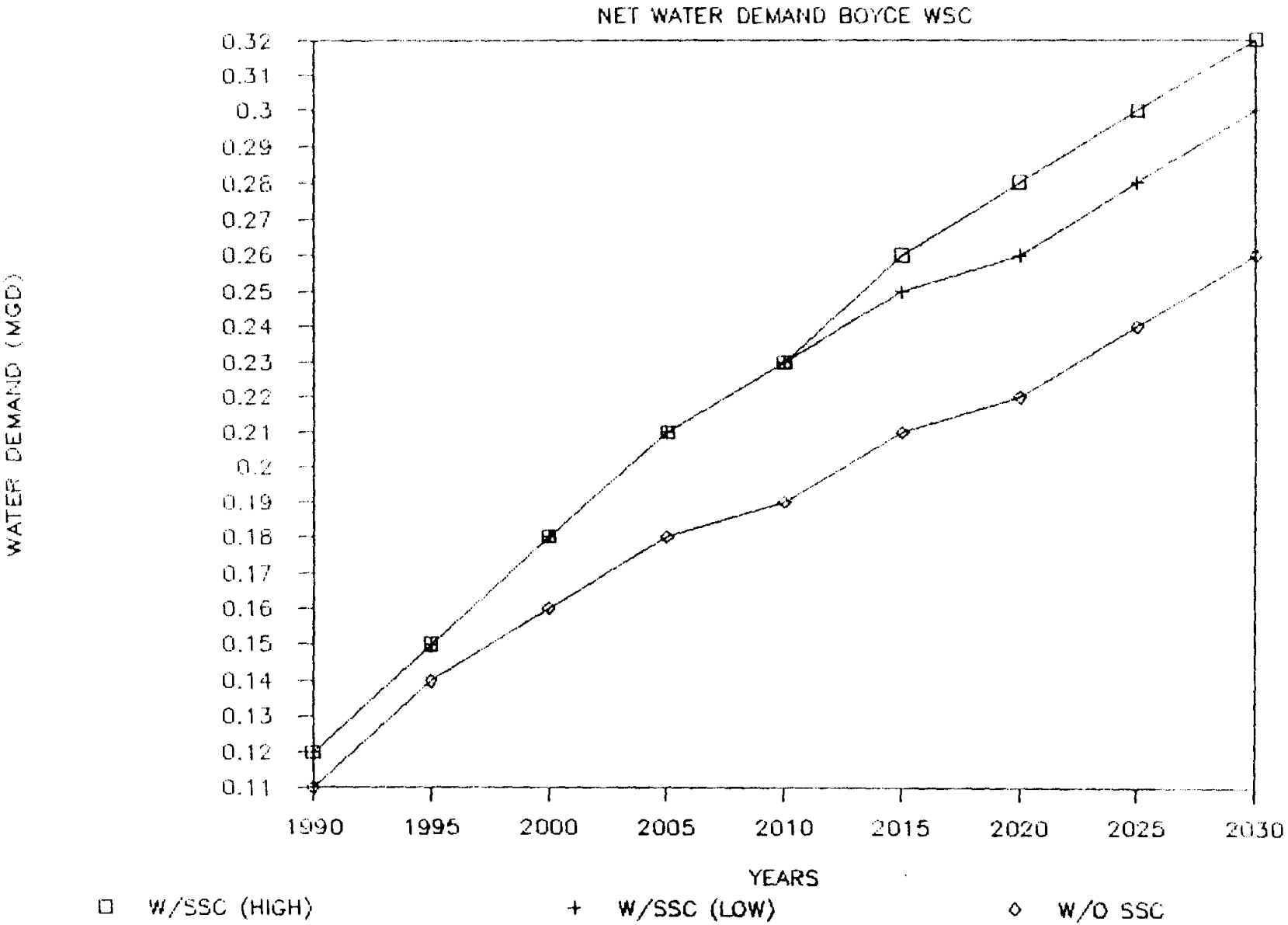
ENTITY	1990	1995	2000	2005	2010	2015	2020	2025	2030
BOYCE WSC	0.12	0.15	0.18	0.21	0.23	0.26	0.28	0.30	0.32
BRISTOL WSC	0.08	0.10	0.12	0.14	0.15	0.17	0.18	0.20	0.21
BUENA-VISTA WSC	0.22	0.28	0.33	0.41	0.48	0.57	0.66	0.76	0.85
EAST GARRETT WSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENNIS	0.00	0.00	0.00	0.13	0.75	1.43	2.12	2.84	3.56
FERRIS	0.35	0.40	0.45	0.50	0.55	0.60	0.64	0.68	0.72
ITALY	0.21	0.27	0.32	0.39	0.46	0.55	0.63	0.71	0.78
MAYPEARL	0.10	0.13	0.15	0.19	0.22	0.26	0.30	0.34	0.37
MIDLOTHIAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MILFORD	0.11	0.14	0.16	0.20	0.23	0.27	0.31	0.36	0.41
PALMER	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.08	0.10
RED OAK	0.00	0.00	0.00	0.04	0.24	0.51	0.78	1.09	1.39
ROCKETT WSC	0.00	0.00	0.00	0.41	1.44	2.50	3.56	4.54	5.52
WAXAHACHIE	0.00	0.00	0.00	0.00	0.00	0.43	1.08	1.61	2.15
WILMER	0.36	0.44	0.51	0.58	0.65	0.72	0.78	0.84	0.90
SSC	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58
SUBTOTAL	3.13	3.49	3.8	4.78	6.98	9.85	12.95	15.93	18.86
CONTINGENCY -20%	0.63	0.70	0.76	0.96	1.40	1.97	2.59	3.19	3.77
L	3.76	4.19	4.56	5.74	8.38	11.82	15.54	19.12	22.63

TABLE 3-12
NET SURFACE WATER DEMAND W/SSC (LOW SCENARIO)
UNITS IN MGD

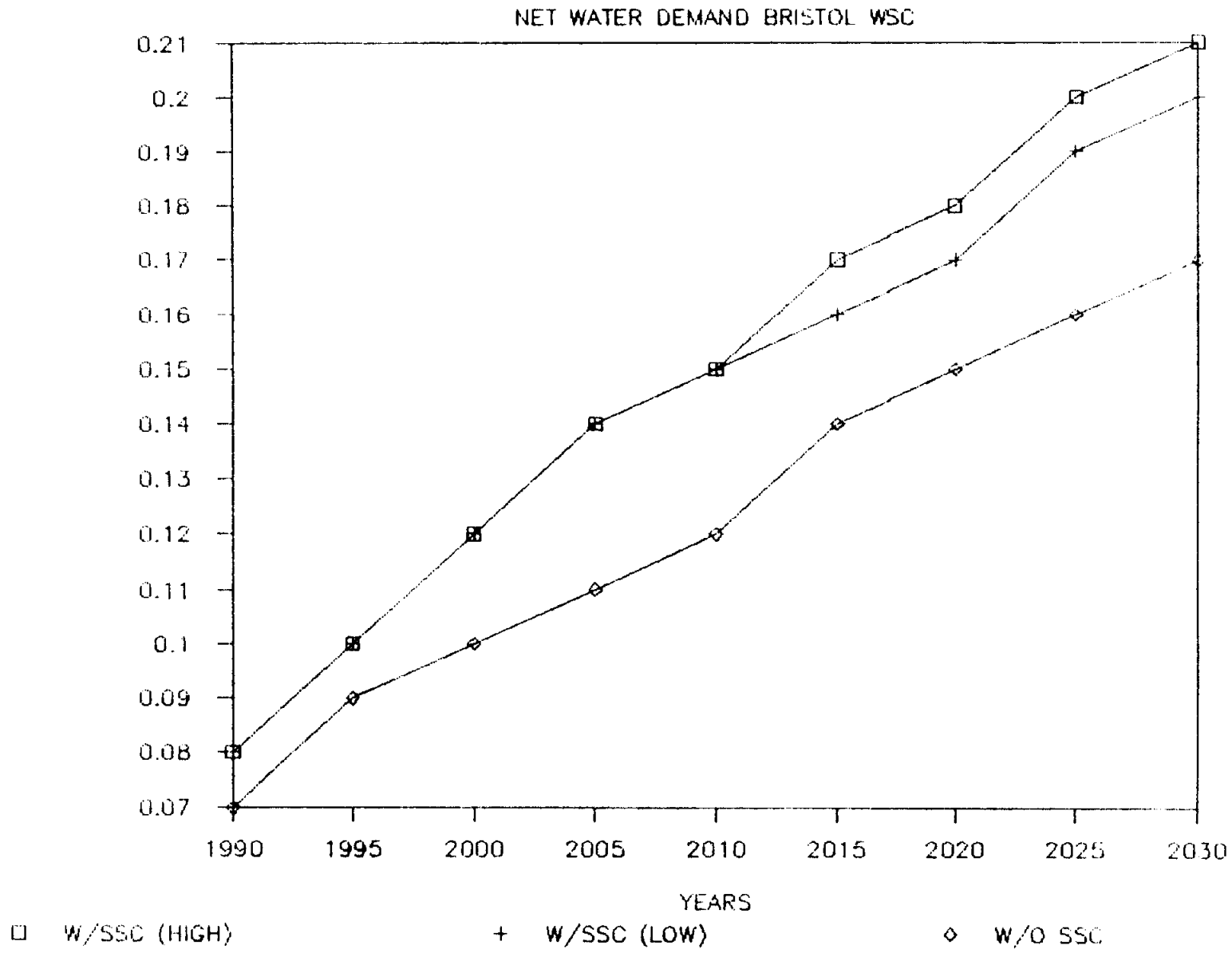
ENTITY	1990	1995	2000	2005	2010	2015	2020	2025	2030
BOYCE WSC	0.12	0.15	0.18	0.21	0.23	0.25	0.26	0.28	0.30
BRISTOL WSC	0.08	0.10	0.12	0.14	0.15	0.16	0.17	0.19	0.20
BUENA-VISTA WSC	0.22	0.28	0.33	0.41	0.48	0.55	0.62	0.72	0.81
EAST GARRETT WSC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENNIS	0.00	0.00	0.00	0.00	0.32	0.69	1.01	1.45	1.88
FERRIS	0.35	0.40	0.45	0.50	0.55	0.58	0.61	0.65	0.68
ITALY	0.21	0.27	0.32	0.39	0.46	0.53	0.60	0.67	0.74
MAYPEARL	0.10	0.13	0.15	0.19	0.22	0.26	0.29	0.32	0.35
MIDLOTHIAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MILFORD	0.11	0.14	0.16	0.20	0.23	0.26	0.29	0.34	0.39
PALMER	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.08
RED OAK	0.00	0.00	0.00	0.04	0.24	0.37	0.49	0.60	0.70
ROCKETT WSC	0.00	0.00	0.00	0.38	1.37	2.37	3.37	4.31	5.24
WAXAHACHIE	0.00	0.00	0.00	0.00	0.00	0.25	0.81	1.25	1.69
WILMER	0.36	0.44	0.51	0.58	0.65	0.7	0.74	0.80	0.86
SSC	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58
SUBTOTAL	3.13	3.49	3.80	4.62	6.48	8.55	10.86	13.21	15.5
CONTINGENCY -20%	0.63	0.70	0.76	0.92	1.30	1.71	2.17	2.64	3.10
TOTAL	3.76	4.19	4.56	5.54	7.78	10.26	13.03	15.85	18.60


ELLIS CO./SOUTHERN DALLAS CO. WSS
NET WATER DEMAND TOTAL STUDY AREA
WATER DEMAND (MGD)
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
1990
1995
2000
2005
2010
2015
2020
2025
2030
YEARS
W/SSC (HIGH)
W/SSC (LOW)
W/O SSC

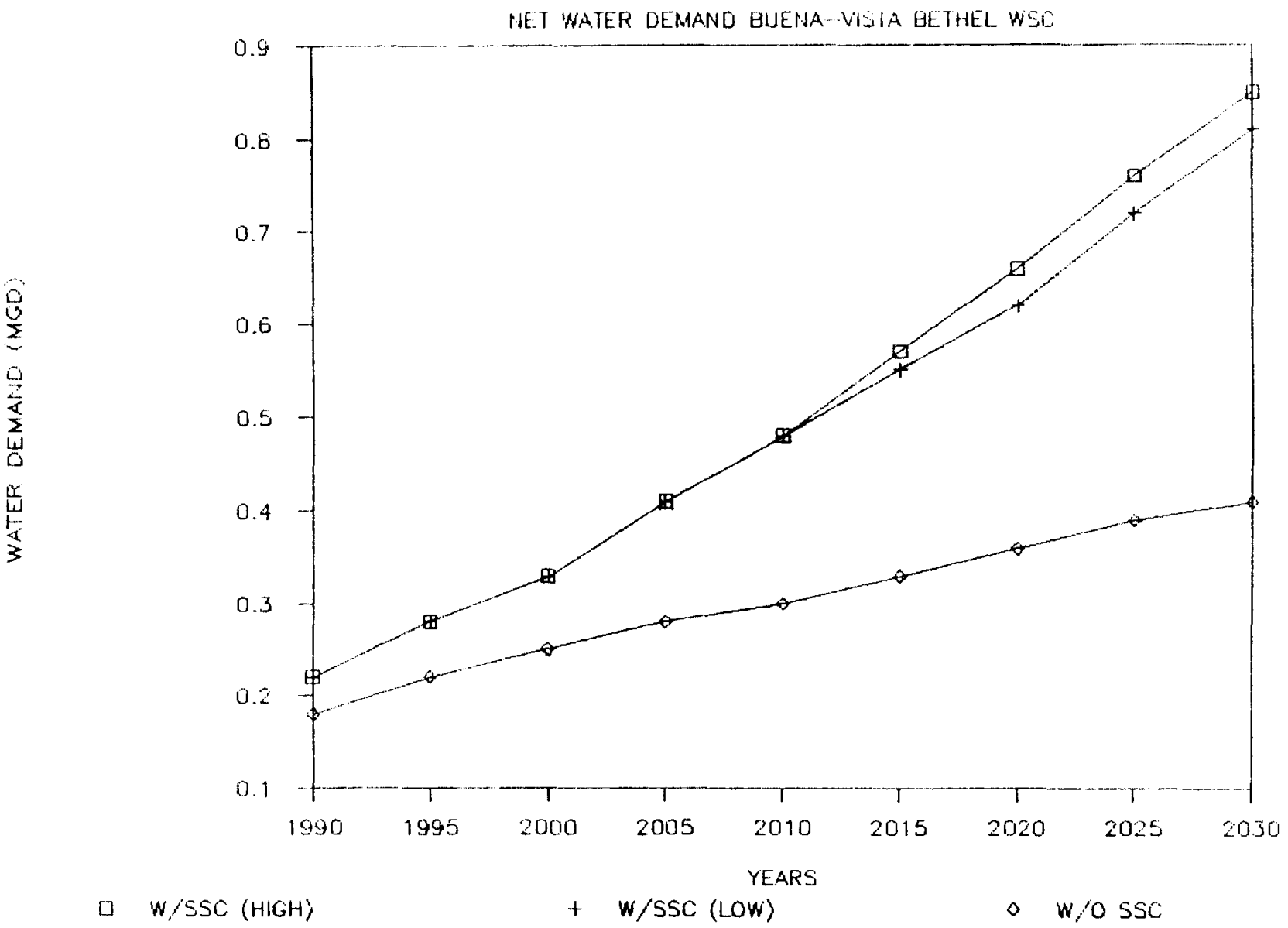
ELLIS CO./SOUTHERN DALLAS CO. WSS



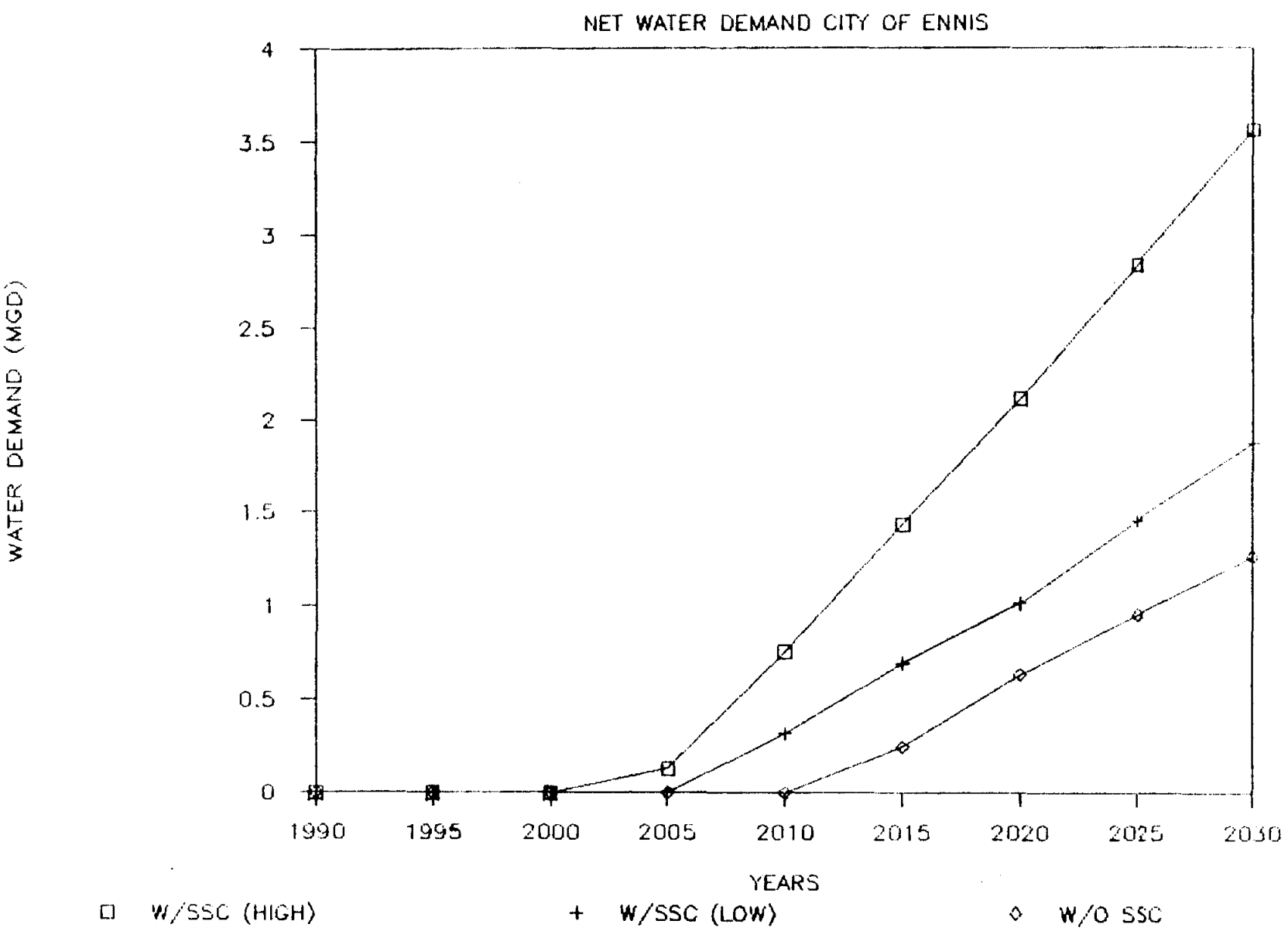
ELLIS CO./SOUTHERN DALLAS CO. WSS

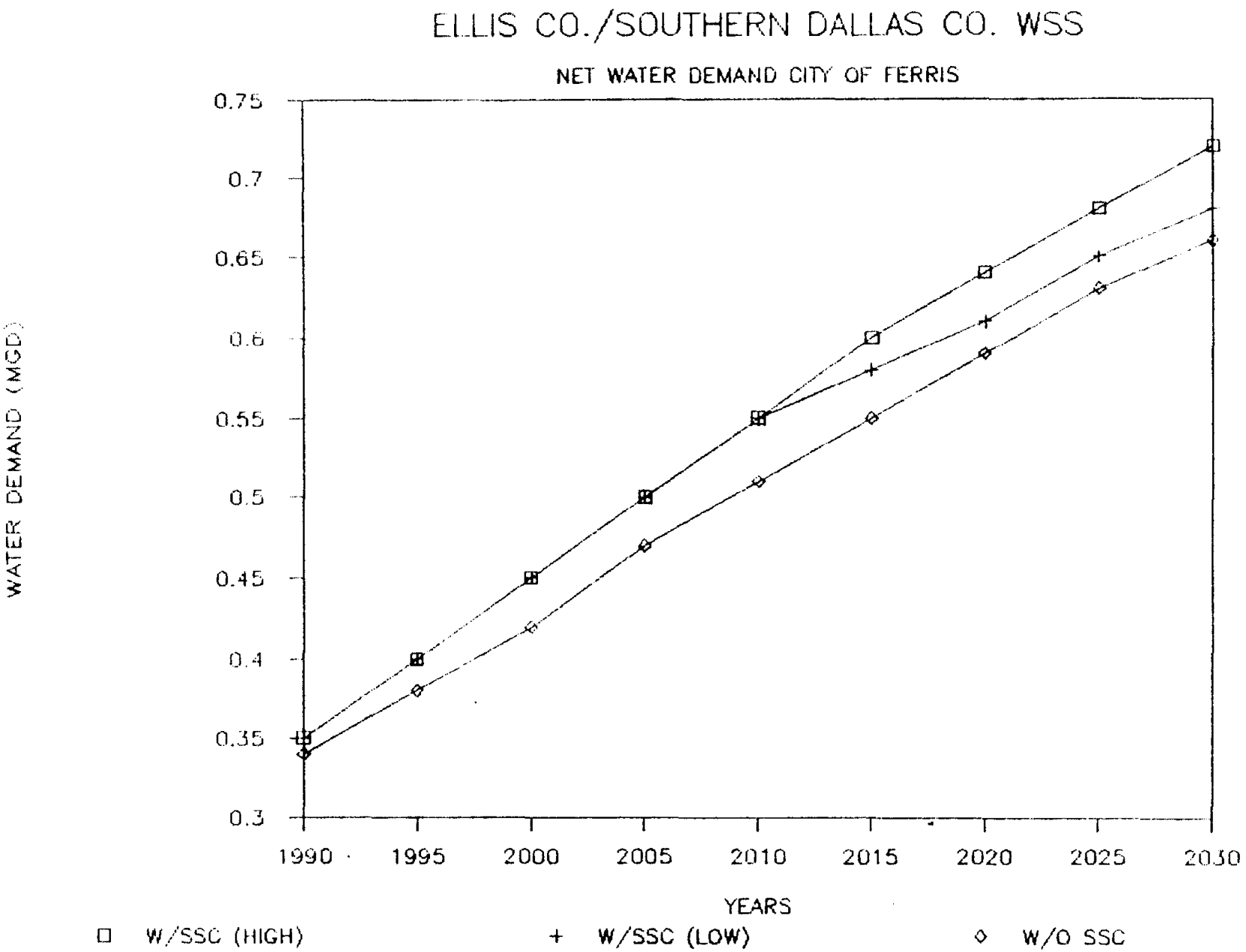


ELLIS CO./SOUTHERN DALLAS CO. WSS

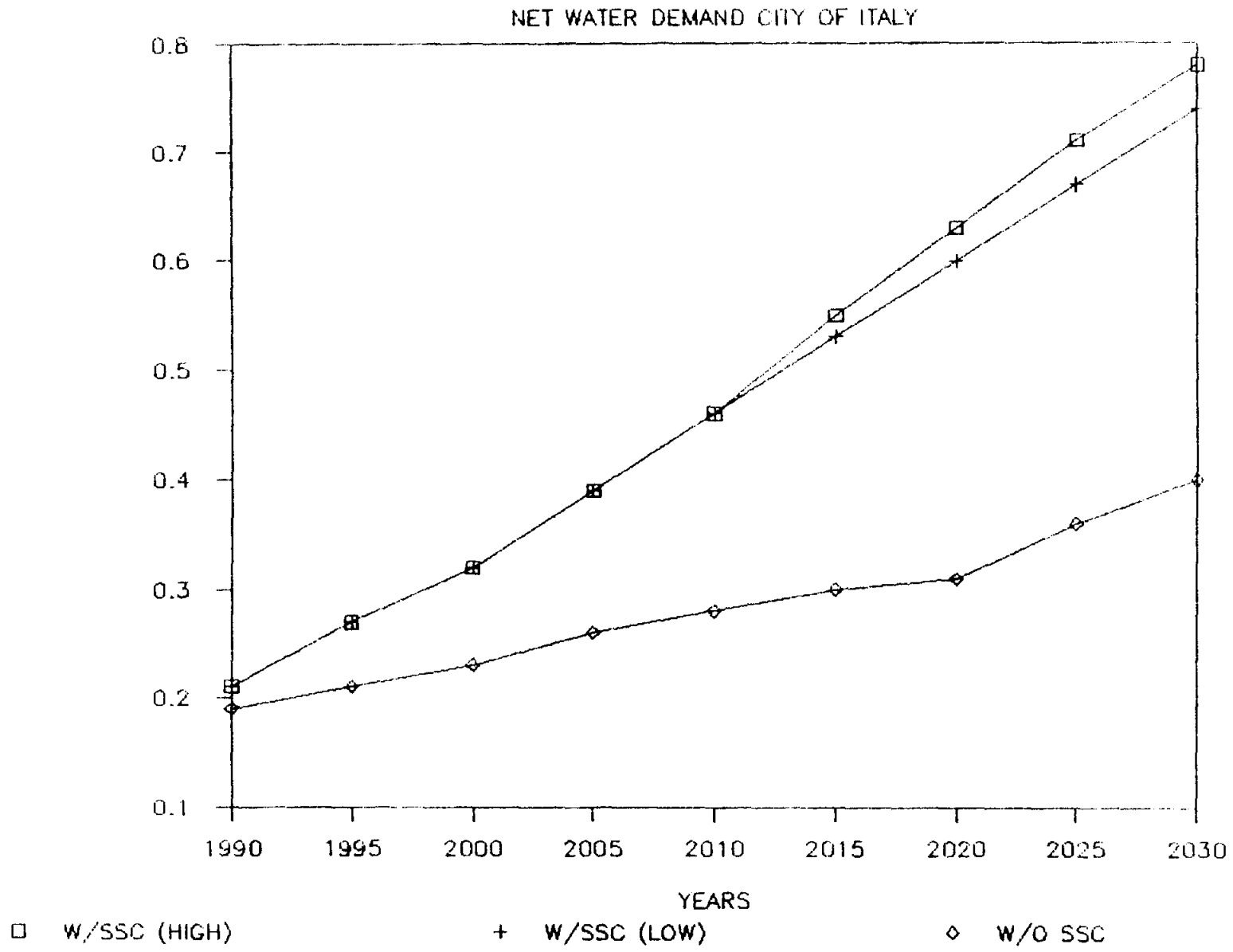


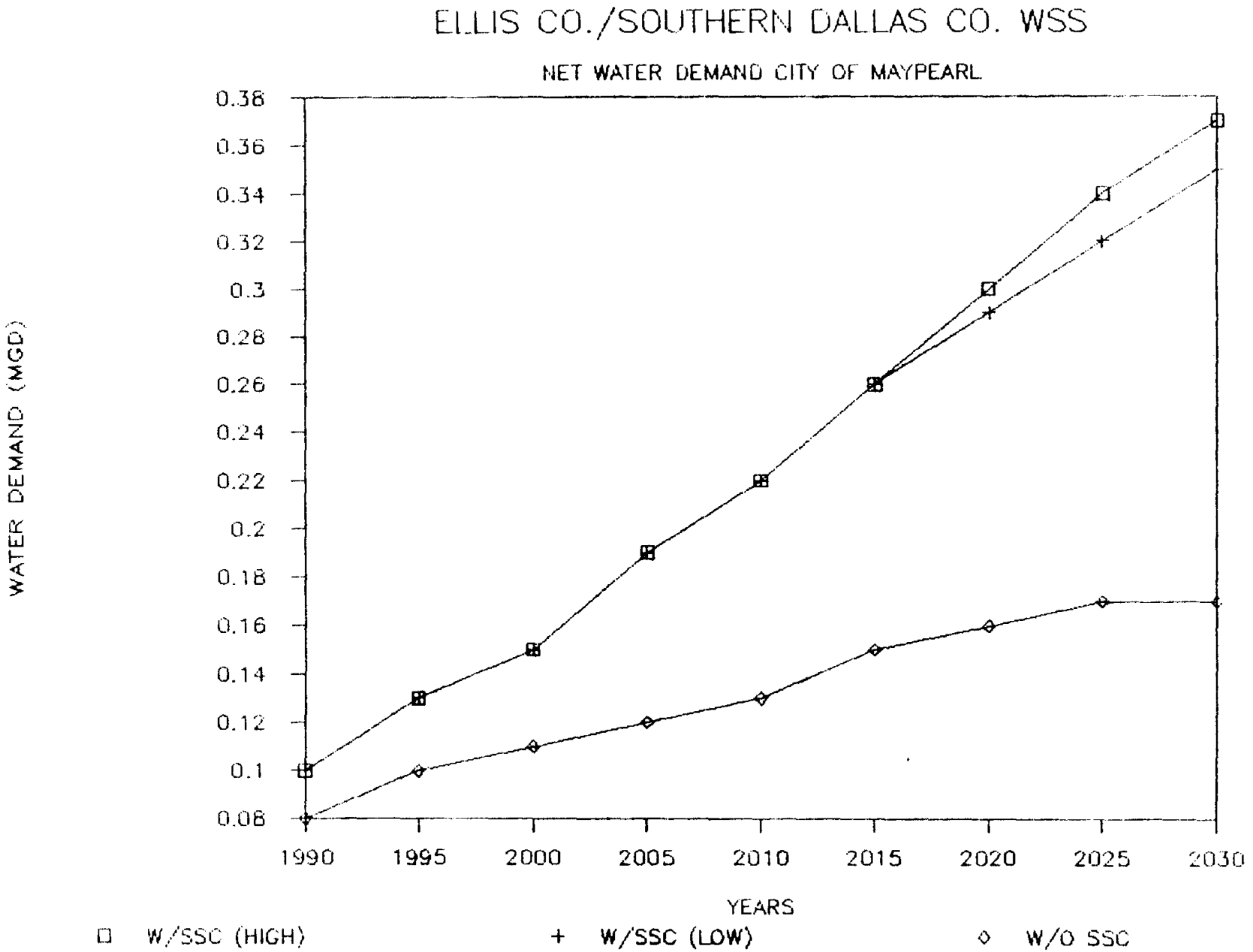
ELLIS CO./SOUTHERN DALLAS CO. WSS

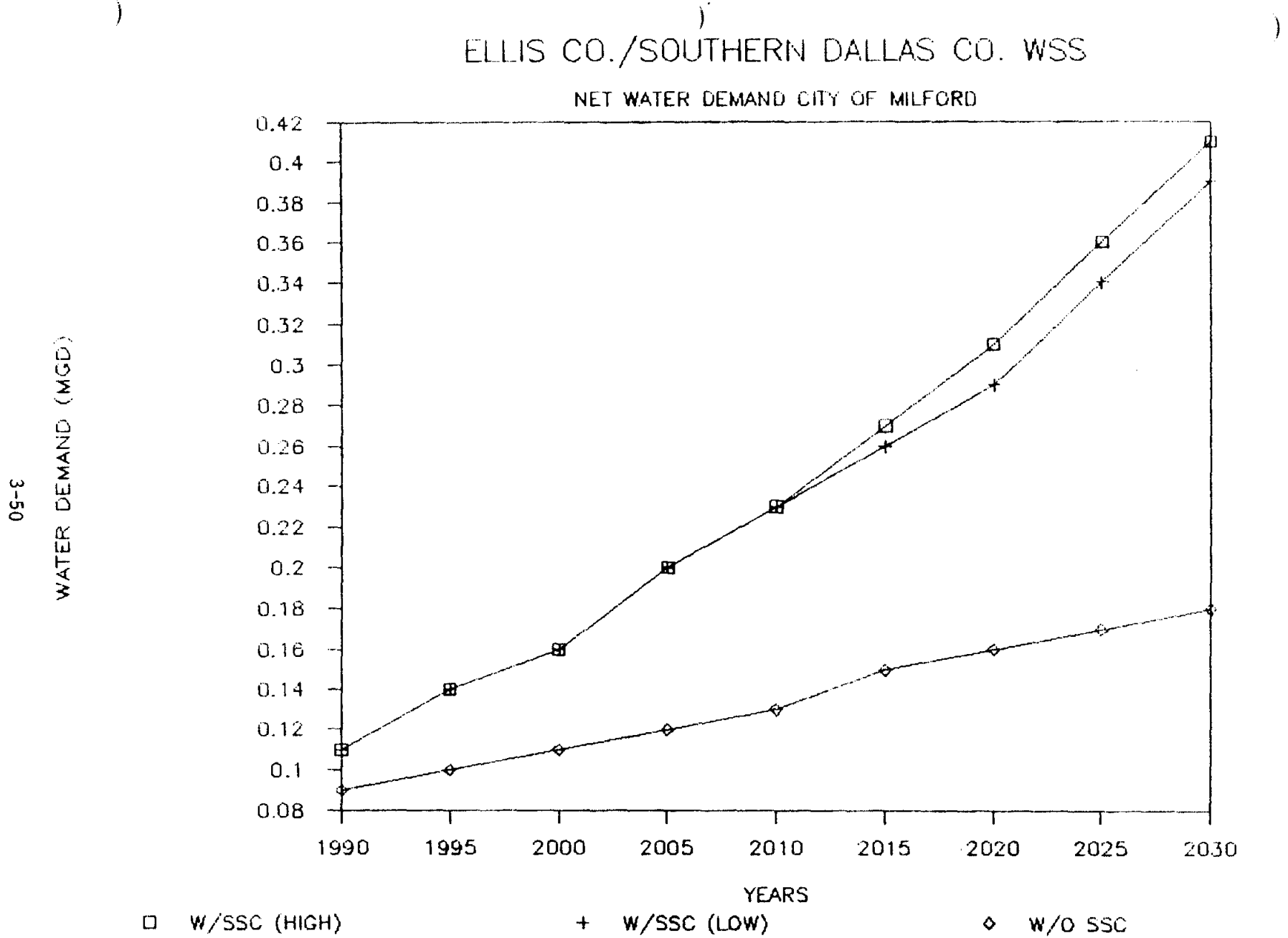



ELLIS CO./SOUTHERN DALLAS CO. WSS
NET WATER DEMAND CITY OF FERRIS
WATER DEMAND (MGD)
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
1990
1995
2000
2005
2010
2015
2020
2025
2030
YEARS
W/SSC (HIGH)
W/SSC (LOW)
W/O SSC

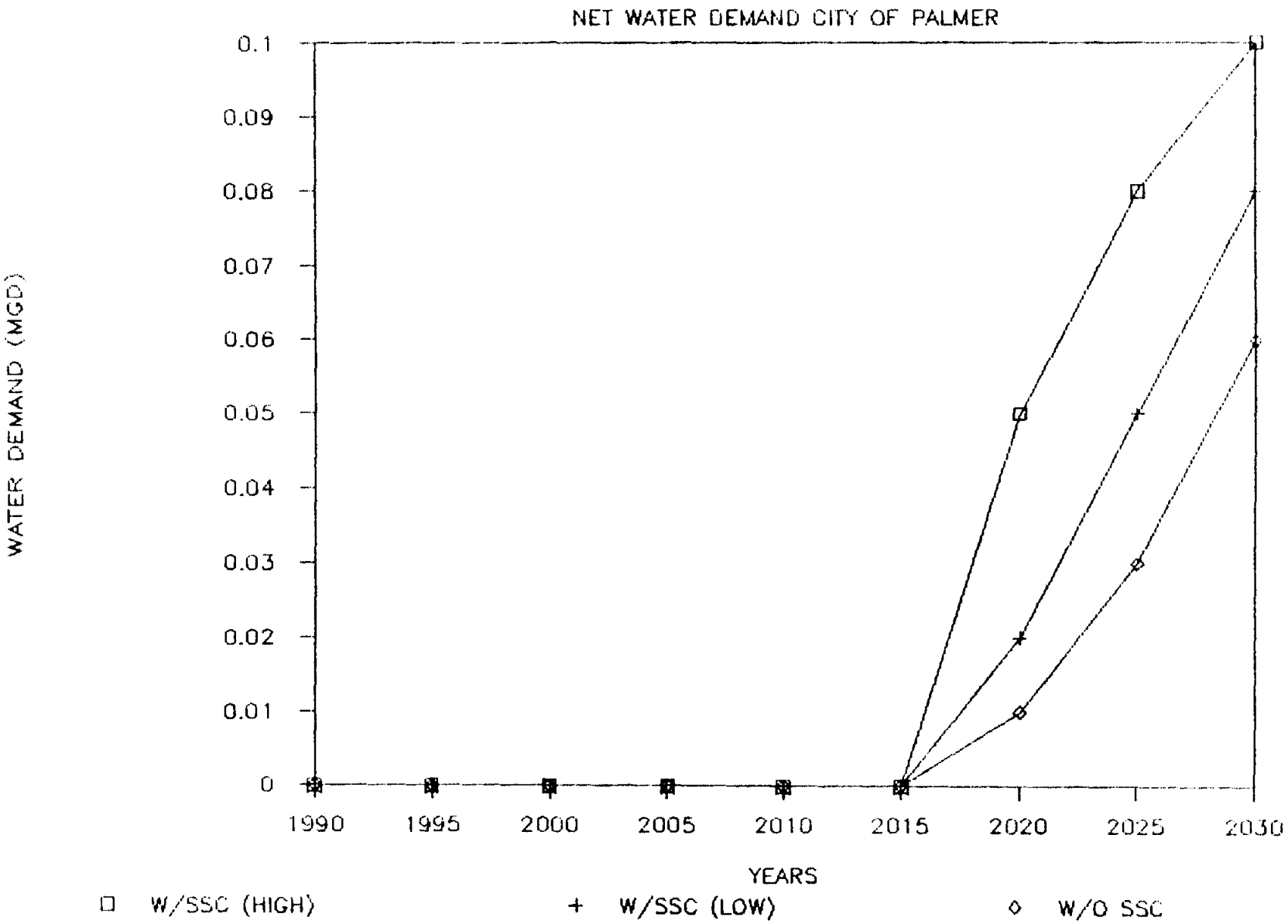
ELLIS CO./SOUTHERN DALLAS CO. WSS

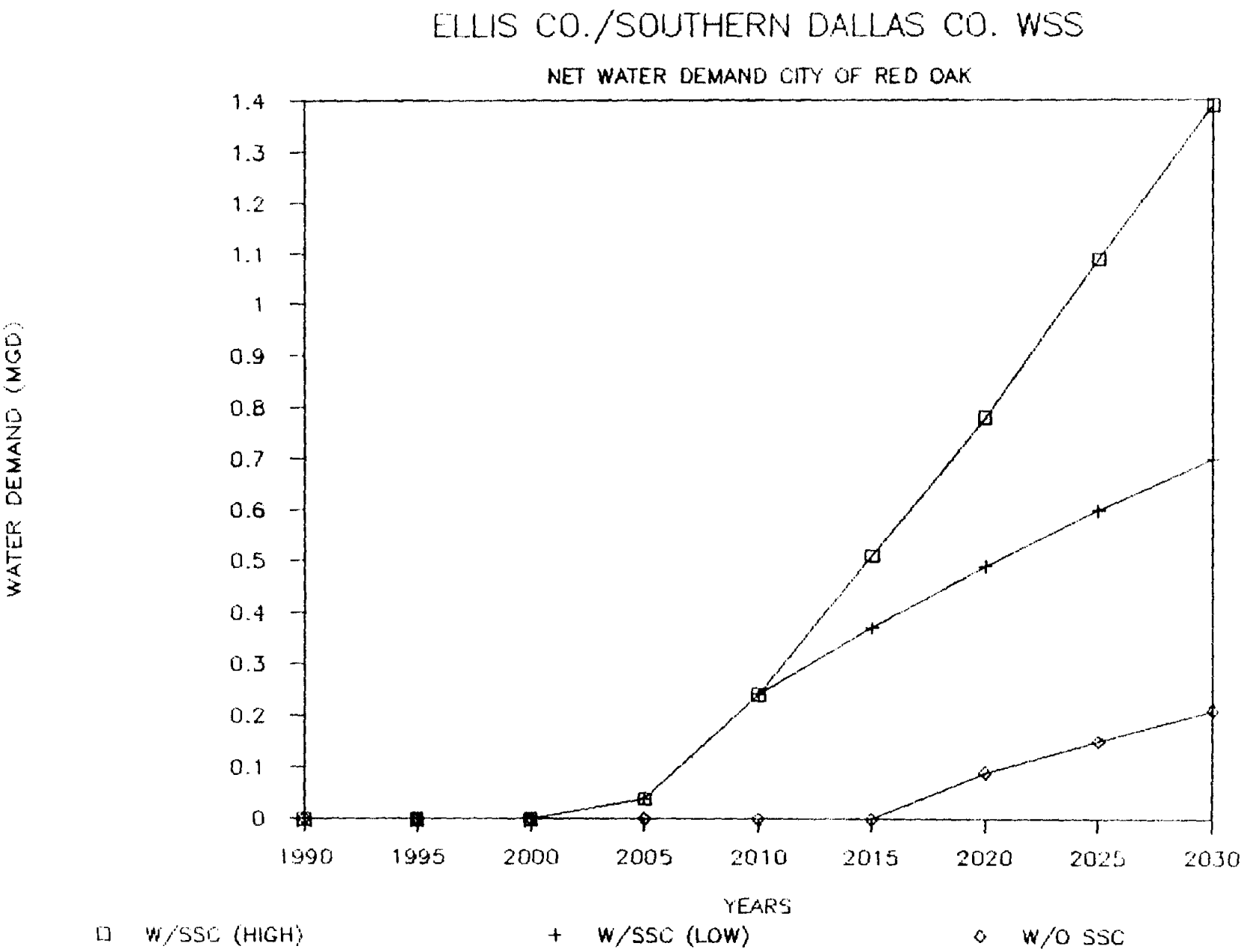



ELLIS CO./SOUTHERN DALLAS CO. WSS
NET WATER DEMAND CITY OF MAYPEARL
WATER DEMAND (MGD)
0.38
0.36
0.34
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
1990
1995
2000
2005
2010
2015
2020
2025
2030
YEARS
W/SSC (HIGH)
W/SSC (LOW)
W/O SSC

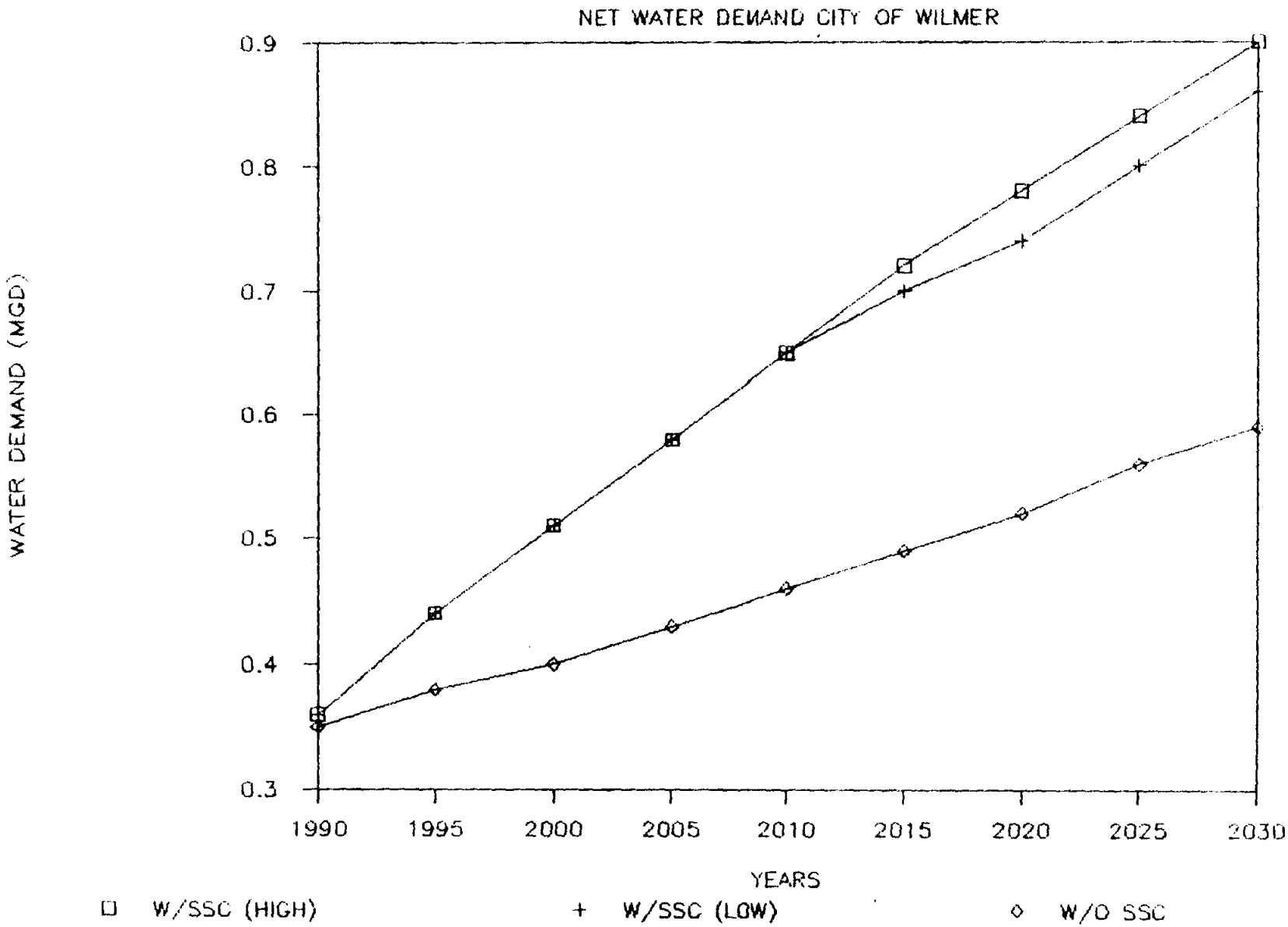

ELLIS CO./SOUTHERN DALLAS CO. WSS
NET WATER DEMAND CITY OF MILFORD
WATER DEMAND (MGD)
0.42
0.4
0.38
0.36
0.34
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
1990
1995
2000
2005
2010
2015
2020
2025
2030
YEARS
W/SSC (HIGH)
W/SSC (LOW)
W/O SSC

ELLIS CO./SOUTHERN DALLAS CO. WSS

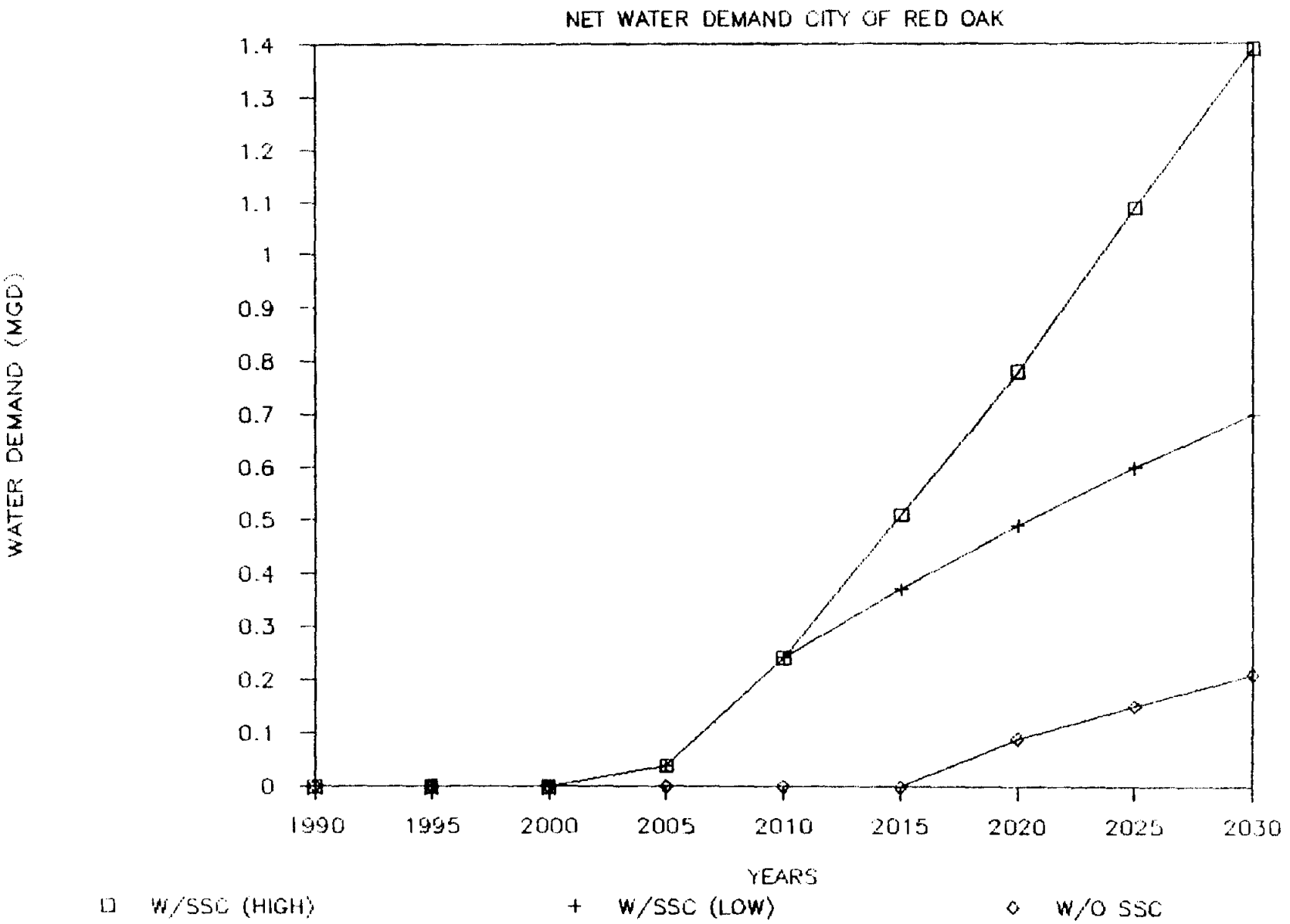


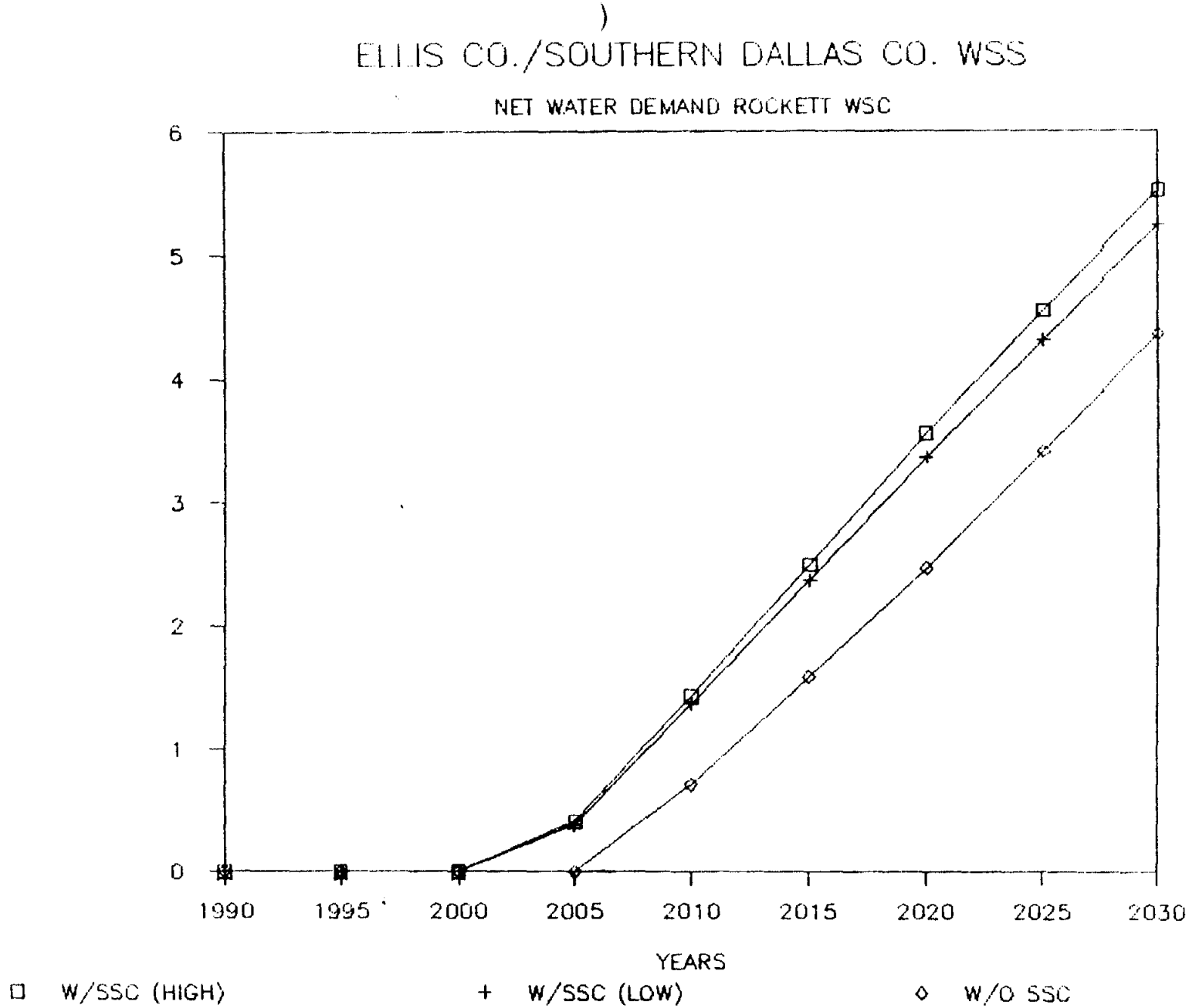

ELLIS CO./SOUTHERN DALLAS CO. WSS
NET WATER DEMAND CITY OF RED OAK
WATER DEMAND (MGD)
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1990
1995
2000
2005
2010
2015
2020
2025
2030
YEARS
W/SSC (HIGH)
W/SSC (LOW)
W/O SSC

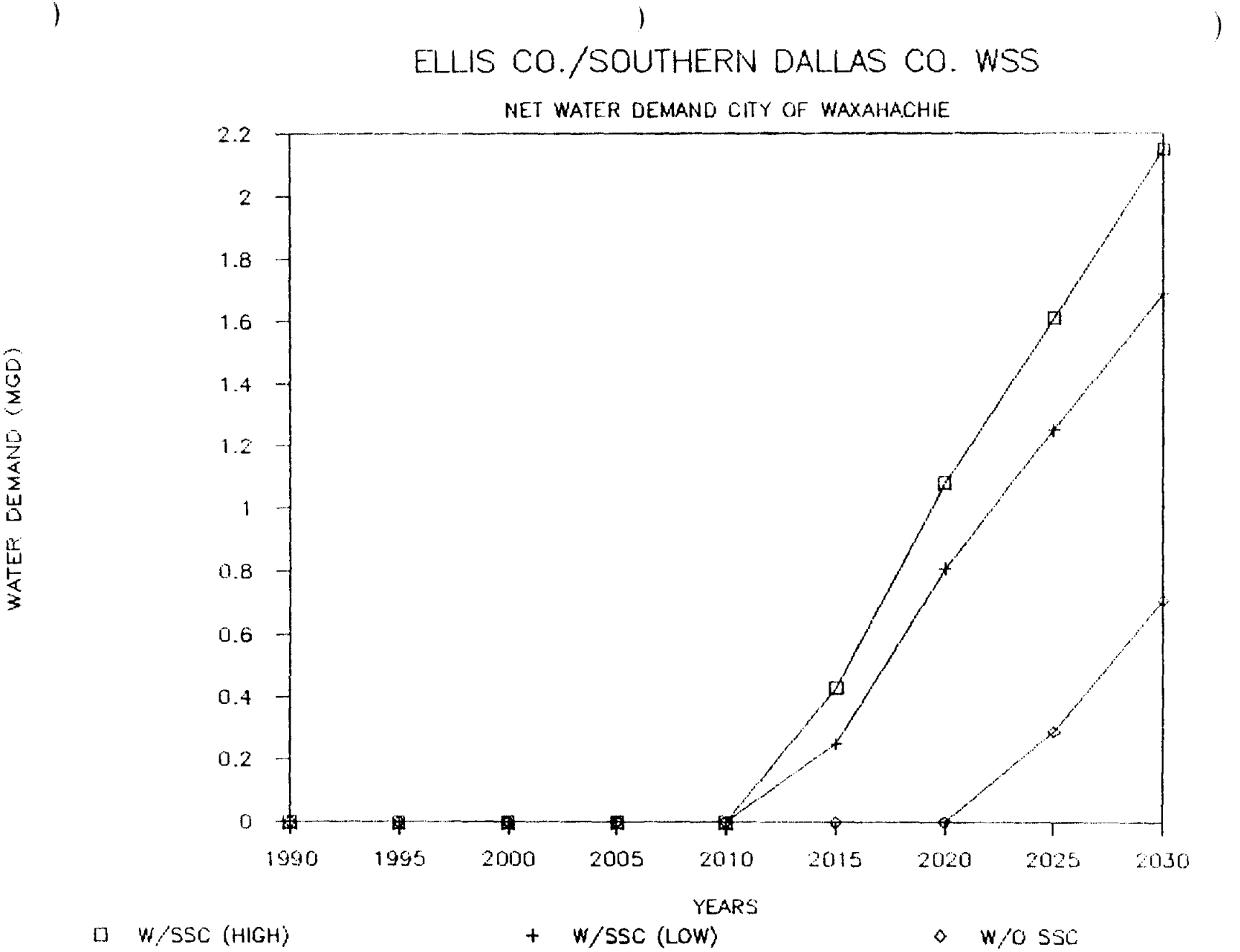
ELLIS CO./SOUTHERN DALLAS CO. WSS

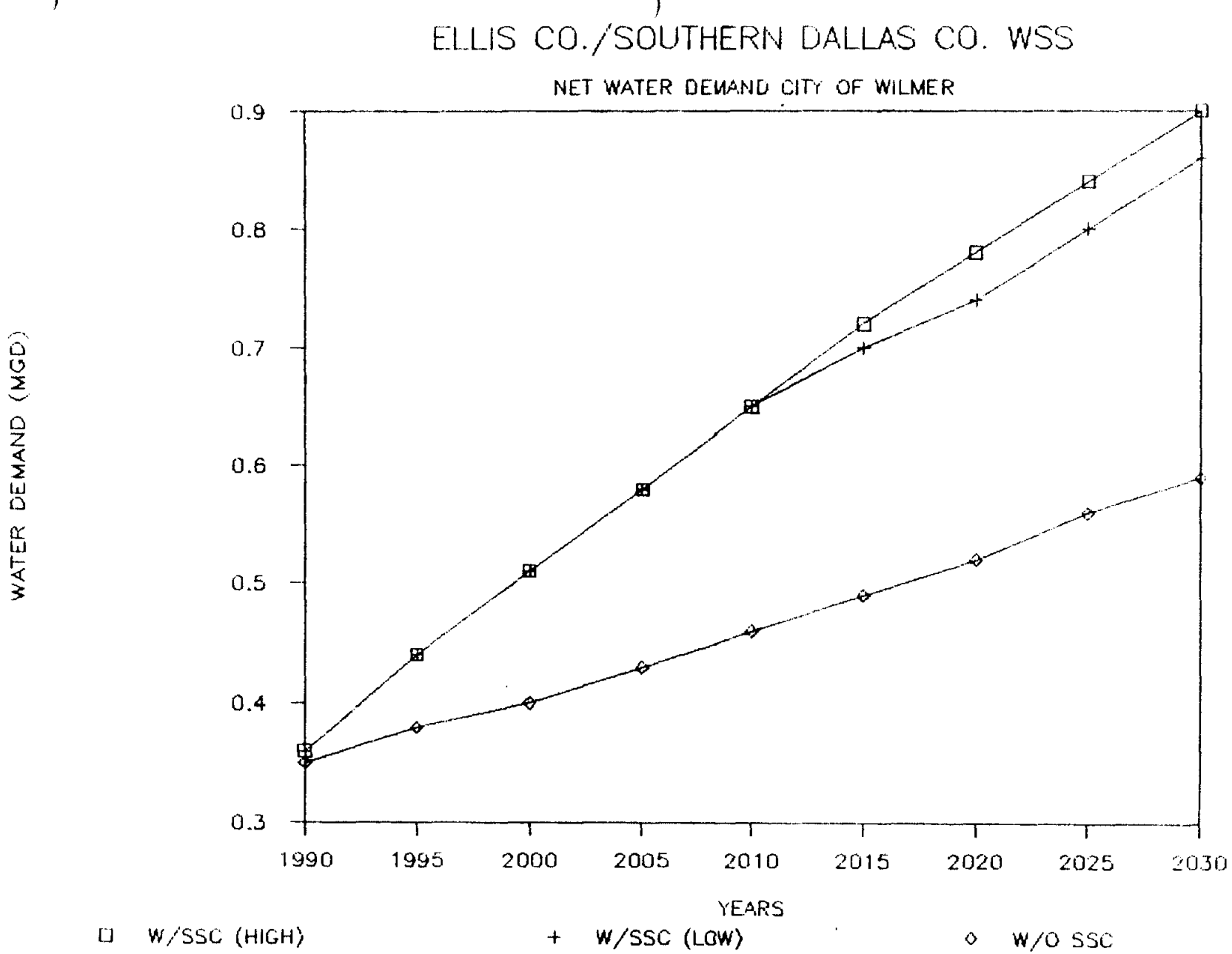


ELLIS CO./SOUTHERN DALLAS CO. WSS




ELLIS CO./SOUTHERN DALLAS CO. WSS
NET WATER DEMAND ROCKETT WSC
WATER DEMAND (MGD)
6
5
4
3
2
1
0
1990
1995
2000
2005
2010
2015
2020
2025
2030
YEARS
W/SSC (HIGH)
W/SSC (LOW)
W/O SSC


ELLIS CO./SOUTHERN DALLAS CO. WSS
NET WATER DEMAND CITY OF WAXAHACHIE
WATER DEMAND (MGD)
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1990
1995
2000
2005
2010
2015
2020
2025
2030
YEARS
W/SSC (HIGH)
W/SSC (LOW)
W/O SSC


ELLIS CO./SOUTHERN DALLAS CO. WSS
NET WATER DEMAND CITY OF WILMER
WATER DEMAND (MGD)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
1990
1995
2000
2005
2010
2015
2020
2025
2030
YEARS
W/SSC (HIGH)
W/SSC (LOW)
W/O SSC

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4.0 WATER SUPPLY SOURCES

4.1 PRIOR STUDIES

Various prior studies were obtained by the Study Team which address possible water supply sources. These are discussed briefly below.

4.1.1 Forrest and Cotton (1972)

Forrest and Cotton, Inc. (FC) prepared a report in May of 1972 which discussed the Italy Reservoir Water Supply Project. Preliminary estimates of firm yield and cost for two reservoir sites in southern Ellis County and northern Navarro County were provided. This report is discussed in further detail in following sections.

4.1.2 Freese and Nichols (date unknown)

In its review of the Richland-Chambers Reservoir site, Freese and Nichols (FN) provided a brief review of the Italy Reservoir site, including discussions of capacity, firm yield and critical period in the context of its impact on the need for Richland-Chambers Reservoir. This report provided no new information for the Study Team in its consideration of the Italy Reservoir sites that had not been provided by other reports.

4.1.3 Hunter Associates (1978)

Hunter Associates, Inc. (HA) in October 1978 published a report regarding three reservoirs known as the Red Oak Creek Water Supply System. This included discussion of population, water usage, possible reservoir sites and construction costs, water treatment and transmission costs, operation, and financing of the project.

4.1.4 Jerry W. Lands, Inc. and Kindle, Stone and Associates, Inc. (1984)

In August 1984, Jerry W. Lands, Inc. (JWL) and Kindle, Stone and Associates, Inc. (KSA) prepared a report for the Rocket Water Supply Corporation regarding Red Oak Creek Reservoir. This report evaluated one of the three sites previously evaluated by HA in 1978. The report included evaluation of water demands, project cost, firm yield of Upper Red Oak Reservoir, geology and soils, project structure requirements and project schedule. This report was used as support for a water appropriation permit application submitted to the Texas Water Commission in 1986 by the Rockett Water Supply Corporation. This application has been continued for at least 12 months by the TWC due to a potential conflict of the reservoir site with the SSC.

4.1.5 Espey, Huston & Associates, Inc. (1986)

In September 1986, EH&A completed the "Trinity River Yield Study, Phase III: Yield Analyses." This report was prepared for the Trinity River Authority of Texas and for the City of Houston. In this report, EH&A performed an analysis of the maximum yield which could be obtained from the Trinity River Basin without system operation, but with maximization of yield at the most upstream reservoir. These yields were computed without regard (in most cases) to downstream water rights for the period of January 1941 through December 1978. Firm yields were computed both for present conditions and for year 2010 conditions, including consideration of eighteen reservoirs for present conditions and thirty-five reservoirs for year 2010 conditions.

4.1.6 U.S. Army Corps of Engineers (1988)

In 1988, the USCE participated in at least two studies regarding Bardwell Lake. The first of these studies involved a request from the Fort Worth District USCE to the Waterways Experiment Station (WES) for analysis of alternatives available for prolonging the life of Bardwell Lake due to sedimentation rates in excess of those anticipated in the original design. WES determined that the sedimentation rate actually being experienced was 4.15 acre-feet per square mile per year (ac-ft/sq mi/yr), whereas the original design rate was 1.02 ac-ft/ sq mi/yr. WES's

conclusions were that before pursuing alternatives to extend the life of Bardwell Lake, confirmation should be obtained of the rate of sedimentation through performance of an additional sedimentation survey.

Subsequent to receipt of this report from WES, the Fort Worth District, USCE has performed a hydrologic analysis of the impacts of increased sedimentation on Bardwell Lake storage, including an analysis of possible raising of the Bardwell Lake normal operating pool to compensate for storage lost due to sedimentation. This unpublished report will be discussed in more detail below.

4.2 SURFACE WATER CONSIDERATIONS

Table 4-1 provides a description of various regional reservoirs, both outside of and within the Trinity River Basin, which were screened for potential use as water supply sources in the Study Area.

The first consideration with respect to surface water availability is water rights. In the case of the Study Area, the following major permits to appropriate the State's water exist:

Permit No.	Permit Holder	Project/Affected Tributaries
P-3216	TCWCID No. 1	Richland-Chambers Reservoir (Chambers Creek)
P-2068	TRA	Bardwell Lake (Waxahachie Creek)
P-1742	Ellis Co. WCID #1	Waxahachie Lake (Waxahachie Creek)
P-1970	TRA/City of Houston	Lake Livingston (Main Stem Trinity River and Tributaries)

There are two permits that affect the planning for additional surface water impoundments in Ellis County. The first, and most comprehensive, is Permit No. 1970. At the time Lake Livingston was permitted, certain water rights for tributary projects upstream of Lake

RESERVOIR INFORMATION FOR WATER SUPPLY SOURCES

(amounts given in ac-ft)

Reservoir Name	County	River Basin	Permit No.	Permit Holder	Authorized Capacity	Authorized Diversion	Type of Use	Contracts	Priority Date
Cooper	Delta & Hopkins	Sulphur	P-2336	Sulphur River Mun. Water Dist.	310,000 81,470 a)	26,960 11,560	Municipal Industrial	Cities of Sulphur Springs, Cooper, & Commerce	Nov 19, 1965
			P-2336	City of Irving	310,000 114,265 a)	44,820 9,180	Municipal Industrial		Nov 19, 1965
			P-2337	N. Texas Municipal Water District	310,000 114,265 a)	54,000 9,180	Municipal Industrial	11 Member Cities	Nov 19, 1965
Lake Fork	Wood	Sabine	P-2948A	Sabine River Auth.	675,819	164,940 b) 24,940 120,000 c) 20,000	Municipal Municipal Industrial	Longview City of Dallas Dallas Power & Light et al.	June 26, 1974
Tawakoni	Van Zandt, and Rains	Sabine	P-1792B	Sabine River Authority	926,000	227,250 3,500	Municipal Industrial	Cash W.S.C. W. Tawakoni Greenville Commerce W. D. Emory Terrell Point Wills Point Longview	Sep 12, 1955
Athens	Henderson	Neches	P-1915	Athens Municipal Water Authority	32,840	8,500	Municipal		Jan 17, 1955
Palestine	Anderson and Cherokee	Neches	P-1832E	Upper Neches River Municipal Water Authority	411,840	212,400 300 100	Municipal Domestic Irrigation	Tyler Palestine Dallas Lakeway Emerald Bay Club Various landowners	Apr. 30, 1956 & Sep. 16, 1969
Waxahachie	Ellis	Trinity	P-1742	Ellis County WCID#1	13,500	2,810	Municipal		Dec. 20, 1954
Bardwell	Ellis	Trinity	P-2068	Trinity River Authority	54,900	9,600	Municipal	Ennis Ellis Co. W.C.I.D.	Jul. 30, 1956
Cedar Creek	Henderson	Trinity	P-1909	Tarrant Co. W.C.I.D. No. 1	678,900	175,000	Municipal	Trinidad Kemp East Cedar Creek Fresh Water Supply District TP&L Mabank	Aug. 12, 1967

TABLE 4-1 (Concluded)

Reservoir Name	County	River Basin	Permit No.	Permit Holder	Authorized Capacity	Authorized Diversion	Type of Use	Contracts	Priority Date
Joe Pool	Tarrant and Dallas	Trinity	P-3260	Trinity River Authority	176,900	17,000	Municipal	Grand Prairie Cedar Hill Duncanville Midlothian Water District	Jan. 20, 1976
Lavon	Collin	Trinity	P-1720	North Texas municipal Water District	100,000	50,000 7,082 2,000	Municipal Industrial Domestic	Garland	Sep. 8, 1953
			P-1720B	North Texas Municipal Water District	280,000 972	36,558	Municipal Industrial		Aug. 2, 1965
Livingston	San Jacinto, Polk and Trinity	Trinity	P-1970	Trinity River Authority & City of Houston	1,750,000	444,000 458,800 13,400	Municipal Industrial Irrigation	TRA City of Houston	Sep. 23,1959
Mountain Creek	Dallas	Trinity	P-1167	Dallas Power and Light Company	22,840	6,400	Industrial		Mar. 12, 1929
Navarro Mills	Navarro	Trinity	P-1948B	Trinity River Authority	63,300	18,850 450	Municipal Industrial		Oct. 4, 1957 Nov. 22, 1982
Richland Creek	Freestone	Trinity	P-3216	Tarrant Co. W.C.I.D. No. 1	1,135,000	210,000	Municipal		Aug. 12, 1957

a) Amount of total allocation to this permit.
b) Subject to special conditions.
c) Includes 30,000 AF to Phillips Coal, 20,000 AF to Tenneco Coal, 17,000 AF for TUGCO, et al., and 10,000 AF for SRA.

Livingston were reserved. Based on TRA's master plan and on the known plans of other governmental entities or special purpose districts, a listing of proposed or planned projects was included in this permit. Lake Livingston's water rights were made subordinate to these projects. In the case of TRA's master plan projects, TRA was given the flexibility to substitute or interchange projects, provided the overall aggregate yield of the reserved projects was not increased. Richland-Chambers Reservoir and Bardwell and Waxahachie Lakes are all superior in right to Permit No. 1970. Any other project in Ellis County would be subordinate to Permit No. 1970.

One other aspect of Permit No. 1970 that bears on other alternatives is that it allows the consumptive use of return flows by upstream entities without limitation. The impact of return flows on yields of existing and future reservoirs within the Trinity River Basin was studied in detail by EH&A in the "Trinity River Yield Study, Phase III: Yield Analysis," published in 1986. This study demonstrates significant increases in firm yields available from Bardwell Lake and Richland-Chambers Reservoir when upstream return flows are included. For purposes of this study, however, the firm yields available from these reservoirs were assumed not to include return flows. (Note that Waxahachie and Joe Pool Lakes were assumed by the 1986 EH&A yield study to have no return flows available to them, hence their firm yields are unimpacted.)

Direct reuse of treated effluent was not considered in this study.

Permit No. 3216 has more significant impact to any project planned upstream. The dependable yield of Richland-Chambers Reservoir is developed from rainfall runoff from the entire watershed. Any upstream project which truncates or preempts the watershed would affect the dependable yield of Richland-Chambers Reservoir. Careful, detailed system operations should be conducted as a first design component to accurately define the impact on yield if a major impoundment is considered for the Chambers Creek watershed. Such an analysis is beyond the scope of this study. In the absence of such a study, proposed impoundments within the Chambers Creek watershed will be considered viable.

The major streams that cross Ellis County are Red Oak Creek and Chambers Creek (along with its major tributary, Waxahachie Creek). From a topographic and geologic perspective, these streams offer several sites that could accommodate dam sites. Two sites have been studied on Chambers Creek: Italy I and Italy II (also called the Rankin site), by the USCE in the 1950's and by Forrest and Cotton (1972). A site below the confluence of Chambers Creek and Waxahachie Creek (Emhouse site) was also studied by the USCE in the 1950's. On Red Oak Creek, two sites have been investigated. The Upper Red Oak site near Palmer, Texas was studied by Hunter and Associates (HA) in 1978 and by Jerry W. Land and Associates and Kindle, Stone and Associates (JWL/KSA) in 1984. The Lower Red Oak site, including a dam site on Bear Creek, was included in the HA 1978 study. This study also included an evaluation of system operations of multiple reservoir combinations among the Upper Red Oak, Lower Red Oak and Bear Creek sites.

4.3 WATER SUPPLY ALTERNATIVES

Some of the more reasonable alternatives that exist with respect to providing additional water supply for Ellis County are:

- Develop One or More New Water Supplies
  - a. Raise conservation pool level in one or more existing lakes (e.g., Bardwell Lake)
  - b. Develop Italy I or II site
  - c. Develop Emhouse site
  - d. Develop Upper Red Oak site
  - e. Develop Lower Red Oak site
  - f. Combinations of the above

- Contract for Raw Water Supply from Existing or Proposed Sources
  - a. TCWCID No. 1 - Richland-Chambers Reservoir
  - b. Sulphur River Municipal Water District - Cooper Reservoir

- Participate in Developing Projects Outside the County
  a. Main stem Trinity River project
  b. Tehuacana Lake (next to Richland-Chambers Reservoir)

- Reuse--A system of augmenting the yield of existing or potential projects by recycling treated wastewater treatment effluent back into the raw water supply.

  The planned reuse of domestic wastewater has been practiced for many years in the United States, and undoubtedly will play an increasing role as water becomes scarce in the future. However, the majority of the existing projects generate water for non-potable uses, such as turf irrigation. There are some that do supplement potable water supplies, but they require extensive treatment and monitoring to ensure that the potable water adequately meets all requirements of the Texas Department of Health and the U.S. EPA.

  The Fred Hervey Water Reclamation Plant in El Paso, Texas is a 10-MGD plant that discharges into the Hueco Bolson aquifer. The reclaimed water helps to recharge the dwindling aquifer, which is the City's primary water supply source.

  The Upper Occoquan Sewage Authority (UOSA) water reclamation plant in Alexandria, Virginia reclaims up to 15 MGD of water, which is discharged to Bull Run Creek. The creek is a tributary of the Occoquan Reservoir, the primary source of drinking water for nearly 750,000 residents of northern Virginia.

  The Hookers Point Supplemental Treatment Facility is capable of providing 20 MGD of reclaimed water to supplement the water supply for Tampa, Florida. The reclaimed water is discharged to the Tampa Bypass Canal and then pumped to the Hillsborough River approximately 5 miles upstream of the City's water treatment plant.

  The City of Denver Metro plant is a demonstration plant producing 1 MGD of potable water. Presently, the water is not introduced into the Denver potable water supply. It is part of a research project evaluating the feasibility of introducing reclaimed water directly into the potable water system

instead of indirectly to a large aquifer like the Hueco Bolson or a large lake such as the Occoquan Reservoir.

All of these projects include extensive water quality monitoring of both the reclaimed water and the receiving waters. Each of these plants has a good track record in performance and reliability, supporting the concept that water reclamation is technically feasible, but several precautions should be considered when water reclamation for supplementing potable water supplies is being proposed.

The following wastewater treatment plants in the North Central Texas Area discharge into reservoirs and/or streams immediately above reservoirs:

County/Plant	Watershed/Segment	BOD/TSS/NH_3-N/P	MG
Dallas			
Dallas Central	Trinity River (TR)/805	10/15/3-5	150
Dallas Southside	TR/805	10/15/3-5	90
TRA Central	West Fork (W.Fk.) TR/805	10/15/3-5	115
TRA Ten Mile Creek	trib. 3 mi from TR/805	10/15	15
Grapevine 101/86	Grapevine Lake/826	10/15	3.75
NTMWD-Mesquite	East Fork (E.Fk.) TR/819	10/15	12.6
NTMWD-Richardson	trib. White Rock Lake/827	10/15	2.25
Garland-Rowlett	trib. Ray Hubbard Lake/820	10/15	16.0
Tarrant			
Fort Worth - Village Creek	W.Fk./805	10/15/3-5	120
Azle-Walnut Creek	Eagle Mountain/809	10/15	.25
Parker			
Weatherford	trib. Clear Fk./831	20/20	2.12
Denton			
Denton	Lewisville Lake/823	10/15	12.0
Lewisville	Elm Fork/822	10/15	6.0
TRA Denton	trib. Grapevine Lake/826	10/15/3	.75
Collin			
NTMWD-Wilson Creek	trib. Lavon Lake/821	10/15/3/2	8.0
NTMWD-Rowlett (Plano)	trib. Ray Hubbard Lake/820	10/15	16

County/Plant	Watershed/Segment	BOD/TSS/NH_3-N/P	MG
Collin (Cont'd)			
Frisco-Stewart	trib. Lewisville Lake/823	20/20/10	.6
Frisco-Cottonwood	trib. Lewisville Lake/823	20/20	.3
Kaufman			
Kaufman	trib. Cedar Creek Lake/818	20/20	.69
Kaufman-Kings Creek	trib. Cedar Creek Lake/818	20/20	3.0
Terrell-Bachelors Creek	trib. Cedar Creek Lake/818	20/20	.4
Garland Duck Creek	E.Fk./819	10/15	30.0
Rockwall			
NTMWD-Rush Creek (Rockwall)	trib. Ray Hubbard Lake/820	10/15	.0213
Cooke			
Gainsville	Elm Fork/824	20/20	2.0

The alternatives are not necessarily stand-alone alternatives (nor is the above list exhaustive). That is, in order to develop the full water supply needs, it may be necessary to evaluate combinations of alternatives. In order to derive a viable set of alternatives, a screening process based primarily on cost, lead-times and perceived permitting/environmental problems was used to limit the study to the most feasible alternatives or combinations of alternatives.

4.3.1 Discussion of Reservoir Projects Considered Not Feasible for Further Analysis

The main stem Trinity River project was eliminated as a viable alternative principally because of the time required to develop such a project. The USCE has studied numerous dam sites along the Trinity River. One of these, the Tennessee Colony site, was authorized for construction by Congress, but no appropriations have been made. Such a project, if built, would represent such a significant yield (362.0 MGD) and, as such, would be outside the scope of this study. An in-channel dam could be constructed on the main stem in order to serve Ellis County; however, this could preempt or complicate the development of a full main stem project. While the project is not considered feasible for the immediate time frame, the study participants should follow the status of any main stem project for future (beyond 2030) purposes.

The Tehuacana project remains a viable project; however, the TCWCID No. 1 has postponed the construction of the project pending the removal of lignite deposits which would be inundated following impoundment at the proposed location. It is unlikely to be developed within the planning horizon. Because of its uncertain status, it was removed as a feasible alternative for the study period. It is seen as a strong candidate for a water supply resource for the period following 2030. If such a project is developed, the Study Area participants should consider joining in the project at that time.

The Emhouse site lies below the confluence of Chambers and Waxahachie Creeks. Its construction would require the major relocation of a railroad, plus it would require protection for the downstream face of Bardwell Dam. These factors, plus the perceived major cost and environmental impact of a reservoir at this site, resulted in the elimination of the Emhouse site from further consideration.

The Italy I site was evaluated next. If fully developed, it would inundate part of the Town of Maypearl. This necessitates either downsizing the project in size (and yield) or selecting an alternative site where impacts would not be as severe (e.g., Italy II). Since the Italy II Reservoir would provide sufficient supply at the same cost as the Italy I Reservoir, but without inundating a community, Italy I Reservoir was eliminated in favor of Italy II Reservoir.

4.3.1 Reuse

Wastewater treatment effluent can be returned to certain lakes to mix with the raw water, and thus augment or increase the dependable yield of the receiving lake. Among others, Joe Pool, Waxahachie and Bardwell Lakes and Red Oak Reservoir are candidates to accommodate this option. Such an option would not in itself develop the Study Area needs, but it represents a significant amount of additional water supply that should be considered. Such an option would require permits or amendments to existing permits in order to implement the process.

For purposes of this study, reuse of return flows was considered from TRA's Central Wastewater Treatment Plant and the proposed Red Oak Regional System WWTP.

4.3.2 Importation of Water

A special case exists with respect to the importation of water from the Sulphur River Basin, i.e., Cooper Reservoir, a USCE project currently under construction. The Sulphur River Municipal Water District (SRMWD), of which the City of Commerce is a member city, owns storage and diversion rights in Cooper Reservoir. The City of Commerce's share of the permitted annual diversion under the Cooper Reservoir Certificate of Adjudication No. 03-4797 (P-2336, A-2414) is 16,106 ac-ft/yr, of which 11,274 ac-ft/yr (70%) is for municipal use and 4,382 ac-ft/yr (30%) is for industrial use. The consulting engineers (Black & Veatch) have determined that the firm yield of Cooper Reservoir is less than the permitted annual diversion. The City of Commerce share of the firm yield of Cooper Reservoir is 13,122 ac-ft/yr.

The City of Commerce is willing to sell all 13,122 ac-ft/yr of its share of the firm yield for a period of up to 50 years at a price equal to Commerce's actual annual cost to the USCE, plus 20% for handling and administration. For years 1-10, the City's costs are $63,241/yr, or $0.015/1,000 gallons. For years 11-50, the City's costs are $255,625/yr or $0.060/1,000 gallons. A purchaser would thus pay 20% more, or $0.018/1,000 gallons for years 1-10, and $0.072/ 1,000 gallons for years 11-50. The proposed purchaser would be responsible for contracts for intake and transmission lines and water transportation and treatment. The City of Commerce would be responsible for the sales contract and assistance in obtaining regulatory approvals.

As an additional item, the City of Commerce presently obtains some of its water (7.5 MGD) from Lake Tawakoni under a long-term contract with the Sabine River Authority (SRA). The City has indicated a willingness to use water from Cooper Reservoir, thereby freeing up the Lake Tawakoni water, if it is in the City's best interest and is approved by SRA.

It is projected that Cooper Reservoir will be completed and will begin impoundment in 1991.

Delivery of the raw water from Cooper Reservoir to Ellis County would require a pipeline some 100 miles in length and would have major capital and operational cost implications. However, the status of this alternative is recommended to be one of deferred status, and other viable alternatives should be examined first.

4.3.3 Bardwell Lake Conservation Pool

The Fort Worth District, USCE is currently studying raising of the conservation pool at Bardwell Lake as a means of offsetting a recently discovered increase in the rate of sediment deposition in the lake over that assumed by the USCE in its original design. This will be discussed in more detail in later sections.

4.3.4 Remaining Alternatives

The water supply sources that remain viable alternatives are:

- Purchasing water from TCWCID No. 1 via the pipeline from Richland-Chambers Reservoir;
- Development of Italy II;
- Development of a Red Oak Reservoir system;
- Reuse of wastewater treatment effluent;
- Interim purchase of water from Sulphur River Basin.

The analysis of providing water supply for the Study Area considers constraints among the alternatives and ultimately relies on combinations of certain of the alternatives. The following section includes a summary description of each viable alternative.

4.4 ALTERNATIVES CONSIDERED

4.4.1 Purchasing Water of TCWCID No. 1

The TCWCID No. 1 pipeline from Richland-Chambers Reservoir crosses Ellis County. Based on informal contact with the District, it has been determined that adequate water is available to meet the Study Area needs. The District prefers that the local customers provide facilities to minimize peak demands on their pipeline system. (See letter from TCWCID No. 1 to TRA dated August 16, 1988, included as Appendix No. 3.) One method of minimizing peak demands would be to develop terminal storage facilities in existing or proposed lakes (Joe Pool, Waxahachie, Bardwell or Red Oak) to store excess water delivered during off-peak periods for subsequent withdrawal during peak demand periods.

This study has utilized the worst-case scenario for the terminal storage concept in that all deliveries are assumed to occur during the off-peak period and peak demands are met by subsequent withdrawal of stored water only. This worst-case analysis provides the most conservative conditions of terminal storage requirements, whereas a more normal scenario might be to deliver water at a "base" flow rate during the entire year and to provide additional deliveries of excess water during the off-peak season. Excess water would be stored until subsequent withdrawals are made to meet peak demand deficits above the base flow rate.

4.4.2 Italy II Reservoir Alone

The Forrest and Cotton (1972) report prepared for TRA provides the sole source of information regarding the Italy Reservoir alternative. This report in actuality studied two Italy reservoir sites. The Italy I Reservoir site would inundate the town of Maypearl, and therefore was discarded for further consideration from this study.

The Italy II Reservoir site controls a drainage area of approximately 532 sq mi (see Figure 4-1). At the assumed normal operating level of elevation 445.0 ft msl, the reservoir would have a storage capacity of approximately 255,000 ac-ft and a surface area of 12,900 ac.

The firm yield of Italy II Reservoir is estimated to be 56,000 ac-ft/yr (50 MGD). The firm yields are based upon the FC report, which excludes consideration of downstream water rights and correction of runoff with regard to the effect of upstream SCS reservoirs. Both of these corrections could significantly reduce the firm yield expected from the reservoir; however, for purposes of this study, the published FC firm yield of 50 MGD for Italy II Reservoir has been adopted.

4.4.3 Red Oak/Bear Creek Systems

The Red Oak system is actually comprised of three separate and distinct reservoir sites, two of which are on Red Oak Creek and one of which is on Bear Creek in northern Ellis County (see Figure 4-1). The firm yield of all three Red Oak system sites combined is less than the Study Area demand requirements, therefore any one or more of the Red Oak system reservoirs must be coupled with an additional surface supply (i.e., Italy II Reservoir) in order to meet the county demand projections.

4.4.3.1 Studies by Others

HA in 1978 studied the Upper Red Oak Reservoir site, the Lower Red Oak Reservoir site, and the Bear Creek Reservoir site, both singly and in various combinations. Table 4-2 provides the pertinent data regarding these reservoirs developed by HA.

In 1984, JWL/KSA studied the Upper Red Oak Creek Reservoir site at various assumed normal water levels and for various conditions of sedimentation. Table 4-2 provides the pertinent results of these studies.

Pursuant to the submittal to the TWC by Rocket Water Supply Corporation of an application for appropriation of surface waters from the proposed Upper Red Oak Reservoir, the TWC performed firm yield analyses, giving full consideration for all downstream water rights, resulting in the computation of an annual firm yield of 3,640 ac-ft/yr for the reservoir under initial conditions. The TWC did not evaluate long-term sediment accumulation in the reservoir and its

TABLE 4-2

RED OAK/BEAR CREEK SYSTEMS FIRM YIELDS

Option	Description	Assumed Normal Operating Elevation (ft msl)	HA (1978) (ac-ft/yr)	KSA/JWL (1984) (ac-ft/yr)	TWC (1988) (ac-ft/yr)	EHA (1989) (ac-ft/yr)
1A	Upper Red Oak Reservoir	460	---	4,646	3,640	3,640
1B	Upper Red Oak Reservoir	465	9.400	---	---	4,726
		466	---	5,290	---	---
2	Lower Red Oak Reservoir	390	8,000	---	---	7,200
3	Bear Creek Reservoir	400	---	---	---	2,750
4	2 plus 3	390,400	12,800	---	---	11,250
5	2, 3, 1A	390,400,460	---	---	---	15,600
6	2, 3, 1B	390,400,465	17,100	---	---	16,700

impact on the firm yield. It is noted that this TWC estimate of firm yield available from Upper Red Oak Reservoir is substantially less than that requested by Rocket Water Supply Corporation based upon on the KSA/JWL Report of 4,646 ac-ft/yr.

4.4.3.2 Firm Yield Analyses Performed by the Study Team

During the course of this current study, the Study Team performed further firm yield analyses of the Red Oak/Bear Creek system. Table 4-2 presents the results obtained by the Study Team, as compared to the results obtained by others.

The Study Team studied Upper Red Oak Reservoir alone at normal operating levels of 460.0 ft msl and 465.0 ft msl, Lower Red Oak Reservoir alone, Bear Creek Reservoir alone, and three combination runs, including Lower Red Oak Reservoir and Bear Creek Reservoir combined, and all three reservoirs combined (two runs).

The methodology in performing the yield runs presented in Table 4-2 was based upon the methodology used by the TWC in its evaluation of Upper Red Oak Reservoir alone. Inflows were determined using the "available flows" obtained from the TWC Hydrology Unit analysis of Upper Red Oak Reservoir. Inflows computed by the TWC were multiplied by drainage area ratios in order to obtain inflows to all three reservoirs. It is noted that the TWC methodology for attaining its inflows to Upper Red Oak Reservoir was simply to analyze Lake Livingston (downstream) and to assume that no flows would be available in the upper basin except during those months in which Lake Livingston spilled. All months in which no spills occurred from Lake Livingston were reduced to zero "available" flows, with the resulting "left over" water comprising the inflows to Upper Red Oak Reservoir used by the TWC. Elevation-area-capacity information was obtained from the HA and KSA/JWL reports. The period of record analyzed was 1950-1958 in order to provide only an analysis of the critical period. Reservoirs were assumed full at the start of each yield run.

4.4.3.3 Discussion

The results of the analysis confirmed the TWC finding that under the assumption stated above, the firm yield of Upper Red Oak Reservoir at a normal operating level of 460.0 ft msl is 3,640 ac-ft/yr (under initial conditions). Raising the Upper Red Oak Reservoir normal operating level by 5 feet to elevation 465.0 ft msl results in an increase in the firm yield of this reservoir to 4,725 ac-ft/yr. (Note that this firm yield is approximately 50% of the firm yield reported by HA in 1978 for the same reservoir site at the same normal operating level. It is the Study Team's belief that the difference in yields is due entirely to HA's non-consideration of downstream water rights, which are fully protected in the Study Team's analyses.)

The Lower Red Oak Reservoir site at elevation 390.0 ft msl would provide a firm yield of 7,200 ac-ft/yr under initial conditions, while fully protecting downstream water rights. When compared to the HA (1978) analysis in which a firm yield of 8,000 ac-ft/yr was obtained, only a small (10%) difference in firm yields exist. It is not entirely clear why the firm yields obtained by HA in 1978 and the Study Team in 1988 were so close, especially given that HA obtained such a different result for Upper Red Oak Reservoir.

The Bear Creek Reservoir site at a normal operating level of 400 ft msl would provide a firm yield of 2,750 ac-ft/yr under initial conditions, fully protecting downstream water rights.

The combination of the Lower Red Oak Reservoir and Bear Creek Reservoir resulted in a firm yield of 11,250 ac-ft/yr, which is also very close to the combined firm yield obtained by HA in 1978 of 12,800 ac-ft/yr. Again, the apparent closeness of this result when compared to the discrepancy of Upper Red Oak Reservoir alone is surprising.

The combination of Upper Red Oak Reservoir, Lower Red Oak Reservoir, and Bear Creek Reservoir for normal operating levels in the Upper Red Oak Reservoir of 460.0 ft msl and 465.0 ft msl results in firm yields of 15,600 ac-ft/yr and 16,700 ac-ft/yr, respectively, for

initial conditions and protecting downstream water rights. The 16,700 ac-ft/yr figure compares very closely to the 17,100 ac-ft/yr obtained by HA in 1978.

The Study Team believes that the studies performed on the Red Oak/Bear Creek system reservoirs and their various combinations provides the best estimate of firm yield which can be obtained from these reservoirs while recognizing downstream water rights. The methodology utilized by the Study Team mirrors that utilized by TWC in its analyses, and with further refinement, would probably suffice as acceptable documentation to the TWC for a permit for appropriation of those waters from the state.

4.4.4 Terminal Storage

Terminal storage, as used in this study, is defined as the short-term (less than one year) storage of pumped water in a reservoir owned by others during periods when the receiving reservoir is below normal operating level. Waters thus stored are rediverted from the reservoir during the short-term period such that, within the short-term period, the net effect on the reservoir storage is zero.

4.4.4.1 Application to Ellis County Study

Terminal storage was evaluated in this study in a general sense due to the availability of water from major reservoirs in other areas of northeast Texas. Also, water is specifically available from the TCWCID No. 1 pipeline, and pursuant to discussions with TCWCID No. 1, could be taken from the pipeline during off-peak periods.

Three existing reservoirs within the Study Area are deemed to be likely candidates for use as terminal storage. These are Joe Pool, Waxahachie and Bardwell Lakes. In addition to these existing reservoirs, the proposed upper Red Oak, lower Red Oak and/or Bear Creek reservoirs could also be future candidates for terminal storage facilities.

4.4.4.2 Terminal Storage Operation

In its simplest form, terminal storage operates in the following manner. Water is pumped into the receiving reservoir at a constant rate over a one-year period, with the total volume pumped being equal to the annual projected demand for that one-year period. Water is then diverted from the reservoir, simultaneously as it is pumped into the reservoir, usually following some demand distribution which matches the actual by within the using entity. Thus, during certain parts of the year, pumpage into the reservoir exceeds pumpage out of the reservoir, but during other parts of the year (particularly in the summer) pumpage out of the reservoir exceeds pumpage into the reservoir. This simplest operation therefore assumes pumpage into the reservoir during 365 days out of the year and pumpage out of the reservoir during 365 days of the year.

The situation anticipated to be more likely to occur within the Ellis County area, and the concept utilized and discussed within this report, is somewhat different. Based upon conversations with the TCWCID No. 1, in which it was stated that water could be obtained from their pipeline mainly during non-peak periods, it has been assumed that water could be taken only during the six-month period from October 1 through March 31 of any given year. During the remaining six months of the year, water can be diverted from the receiving reservoir, but cannot be pumped from the TCWCID No. 1 pipeline.

As utilized in this study, such a requirement on use of a reservoir for terminal storage requires that, during the six months of pumped inflow, the pumped inflow rate must be twice the annual demand rate in order to store sufficient water during the six winter months such that water would exist in storage to be diverted during the six summer months. (Note that this scenario ignores monthly differences in distributed demand caused by seasonal variations in demand.)

4.4.4.3 Right to Use Storage

There are four generic methodologies by which reservoirs can be used as terminal storage.

The first methodology would be to construct a new reservoir, perhaps off-channel, that would be used solely for terminal storage of water. This is a relatively simple concept, but inherently has many of the problems associated with construction of a new reservoir, i.e., cost, time and environmental concerns.

The second generic methodology is to contract with the existing owners of the reservoir to use unused conservation storage capacity at times when the level of the reservoir due to natural inflows is below normal conservation pool.

The third methodology is to purchase a share of the existing conservation storage within the reservoir, either from the existing owners or, if uncontracted for from the original constructor of the reservoir, then from the original constructor.

The fourth methodology would be to modify an existing reservoir, either by raising of the dam or by reallocation of the flood pool of an existing dam.

4.4.4.4 Terminal Storage Operation Used in This Study

Within this study, it has been assumed that the methodology to be used for terminal storage would be the second of the four methodologies discussed above, i.e., to utilize only unused conservation storage capacity to temporarily store water. This would require a contractual arrangement with the existing owners and contractees for water from the reservoir, and would have many technical, contractual and other issues which would need to be resolved before it could be implemented. For purpose of this study, it has been assumed that these issues would be resolved at a later date.

In addition to the unused storage capacity concept, the Fort Worth District, USCE is evaluating modification of Bardwell Lake to include reallocation of the existing flood pool in order to compensate for increased sedimentation being experienced in that reservoir. This will be discussed in detail below; however, the unused storage concept has been assumed to apply in this study whether or not Bardwell flood pool storage is reallocated.

4.4.4.5 Terminal Storage Operation When Regional Entity Contracts Only for Unused Storage

In its simplest form, terminal storage under the unused storage concept would have three conditions. These are: (1) when the reservoir is at the normal operating level, (2) when the reservoir is below the normal operating level and (3) when the reservoir is above the normal operating level (i.e., flood spills are occurring from the reservoir).

When the reservoir is at the normal operating level, no terminal storage would be available. This is because all of the existing conservation storage is full.

When the reservoir is below the normal operating level, any of the unused conservation storage capacity could be available for the terminal storage user to fill using pumped water. It is more likely, however, that the terminal storage user would have contracted with the original owners of the reservoir to store no more than some fixed volume of water within the reservoir at any given time. Thus, if the amount of drawdown below the normal operating level is less than the agreed-upon amount, only the amount of water which could be stored in the available drawdown can be pumped into the reservoir. If, however, the reservoir is drawn down sufficient that the available storage exceeds the contracted storage volume, then the terminal storage user is limited by the contractual amount to the volume he may place within the reservoir. One other item of note for this condition is that the terminal storage user would bear, in all likelihood, 100% of the impact of the increased evaporation from the reservoir. Thus, the amount pumped in would likely be more than the amount which could be rediverted due to this evaporation loss. For purpose of costing in this study, this loss has been assumed to be 10%.

Under the third scenario, i.e., when spills are occurring, the concept used in this study is that if water has been placed in terminal storage, and if flood inflows occur such that spills occur from the reservoir, then the "stored water" is spilled first. Thus, if the volume of the spill is less than the amount of water which was previously stored, then the terminal storer has only the difference between what he had previously put in the reservoir and what had been spilled

as his remaining volume in storage. If, however, the volume of the spill exceeds the previously stored volume, then the terminal storer would lose 100% of his pumped water.

Three operational approaches to terminal storage are possible to maximize the effective transfer of water and minimize any losses of pumped water:

1. Utilization of Existing Conservation Storage Space. In this approach, an agreement with the existing reservoir owner would be structured such that the top 5 feet of conservation pool water are diverted and then replaced later. This minimizes any potential spillage of transferred water. Below 5 feet, water would be pumped in prior to diversion.

2. Dedication of New Conservation Pool. In the case of Lake Bardwell, it may be possible to reallocate flood pool to conservation pool, which would reduce the frequency of spills.

3. Longer Delivery Period from TCWCID #1. Through negotiation with TCWCID #1, a longer delivery period, approaching perhaps the daily supply of average daily requirements, may be structured. This would have the advantage of minimizing the necessary volume of terminal storage space required.

These operational approaches would need to be evaluated in detail at the time of implementation.

4.4.4.6 Summary of Terminal Storage Concept

In summary, terminal storage is an attempt to utilize unfiltered conservation pool to maximize the water withdrawal from an existing impoundment. Reservoirs for immediate consideration include Joe Pool, Waxahachie and Bardwell Lakes. Each of these reservoirs has water rights established with the following parties:

Reservoir Name	Contracts
Joe Pool	Grand Prairie
	Cedar Hill
	Duncanville
	Midlothian Water District
Waxahachie	Ellis County WCID No. 1
Bardwell	Ennis
	Ellis County WCID No. 1

This system would require a detailed accounting system that would monitor pumped inflows and flood spills, but it is easily implemented using existing metering and flow measuring technology. Of course, the terminal user would also bear any costs of implementation of the program such that the existing owners and/or users of the terminal storage reservoir would not be impacted in any way.

This does not preclude the possibility that other methodologies identified above could be used in the terminal storage concept. For instance, an increased supply duration by TCWCID #1 may work to reduce terminal storage requirements, and ultimately reduce project costs. These methodologies would need to be evaluated by all parties concerned in a detailed manner, when a detailed study and/or contractual negotiations can be performed.

In the following sections, a detailed discussion is presented regarding evaluations of Bardwell Lake as a terminal storage reservoir, particularly studies which have been performed by the Fort Worth District, USCE. These studies are an example of preliminary studies which could be performed, and they provide further insight into the option of reallocation of a portion of the flood pool of an existing reservoir.

4.4.5 Bardwell Lake Terminal Storage

4.4.5.1 Existing Utilization

Bardwell Lake is owned by the USCE. The permit holder for the water rights from the reservoir is the Trinity River Authority, which has a permit to divert 9,600 ac-ft/yr for municipal purposes. By contract, the City of Ennis has the right to divert 5,280 ac-ft/yr and the Ellis County WCID has the right to divert 4,320 ac-ft/yr.

4.4.5.2 Sedimentation

The USCE has performed certain evaluations of Bardwell Lake with respect to sedimentation which has been occurring in the lake. As discussed earlier in this report, the WES performed an analysis in December 1988 and determined that insufficient data existed to conclusively state that the 4.1 ac-ft/sq mi/yr sedimentation rate which had been measured between 1972 and 1981 into Bardwell Lake was, in fact, the proper amount to be utilized for future studies. (The original design sedimentation rate for the reservoir was 1.02 ac-ft/ sq mi/yr.) In conclusion, WES recommended that before pursuing alternatives to extend the life of Bardwell Lake, that confirmation of the sedimentation rate should occur through the performance of an additional sedimentation survey. The significant issues to be addressed in this additional study were recommended to include the amount of densification and consolidation of sediments which would occur as they accumulate on the bottom of Bardwell Lake.

Subsequent to this evaluation by WES, the Fort Worth District, USCE has performed certain preliminary, unpublished analyses of the impact on firm yield from Bardwell Lake of various sedimentation assumptions. The Study Team has met with Fort Worth District personnel, and has cooperated with their efforts to study Bardwell Lake. Additionally, permission was obtained to use the results of the Fort Worth District studies, with the proviso that the results are strictly preliminary and subject to change.

The Fort Worth District also looked at the impact on firm yield of raising the normal operating level of Bardwell Lake.

The unpublished USCE report references the 4.15 ac-ft/sq mi/yr sedimentation rate found in the 1981 sediment survey; however, the report indicates that the Fort Worth District has determined that the consolidation and densification of the sediments which can be expected to occur over the project life will reduce the actual loss of storage to an effective rate of 2.5 ac-ft/sq mi/yr for the period from 1965 to 1990, and to an effective rate of 1.833 ac-ft/sq mi/yr for the period from 1990 to 2065. Following this determination and distribution of the assumed sediment throughout the conservation and flood control pool, the Fort Worth District performed yield studies and flood routings for Bardwell Lake. Only the results of the yield studies will be discussed herein.

4.4.5.3 Yield Analyses Performed by Fort Worth District, USCE

Two analyses were performed by the Fort Worth District, USCE:

(1) The first analysis dealt with determining the dependable yield from Bardwell Lake assuming the normal pool were raised by 5 feet and 11 feet.

(2) The second analysis dealt with determining the impact on the firm yield of Richland-Chambers Reservoir of raising of the normal pool of Bardwell Lake by 5 feet and 8 feet.

The currently authorized diversion from Bardwell Lake is 8.57 MGD (9,600 ac-ft/yr). The USCE study determined that the firm yield for Bardwell Lake using 1990 sedimentation accumulation assumptions would be 9.8 MGD, and under 2065 sedimentation assumptions would be 6.0 MGD. These results and the results of other scenarios evaluated are contained within Table 4-3.

TABLE 4-3

RESULTS OF USCE PRELIMINARY STUDY OF REALLOCATION
OF BARDWELL RESERVOIR STORAGE

Assumed Bardwell Lake Normal Operating Level (ft msl)	1990 Conditions			2065 Conditions		
	Storage Capacity (ac-ft)	Firm Yield (ac-ft/yr)	Firm Yield (mgd)	Storage Capacity (ac-ft)	Firm Yield (ac-ft/yr)	Firm Yield (mgd)
421	45,347	10,977	9.8	28,400	6,721	6.0
426	64,435	13,218	11.8	45,200	9,969	8.9
432	91,400	16,018	14.3	70,038	12,882	11.5

Source: Unpublished preliminary draft report, USCE, Fort Worth District, 1988.

4.4.5.4 Effect on Richland-Chambers Reservoir

With respect to the effect on Richland-Chambers Reservoir, the USCE determined, as shown in Table 4-4, that under 2065 conditions, raising of the conservation pool would have no impact on Richland-Chambers Reservoir's firm yield, i.e., the firm yield would be 264.5 cfs under 2065 conditions no matter what elevation the conservation pool was raised to. However, under 1985 conditions, the USCE study indicated that the Richland-Chambers Reservoir firm yield would be slightly reduced from 336.7 cfs to 335.9 cfs by raising Bardwell Lake's conservation pool 5 feet, and from 336.7 cfs to 335.4 cfs if it was raised 8 feet.

4.4.5.5 Application to Current Study

Due to the fact that the USCE study assumes a 100-year project life for Bardwell Lake starting in 1965, the Study Team recommends that a 40-year life starting in year 1990 be used for purposes of this study. Interpolating linearly using the USCE figures, a firm yield of 8.03 MGD results for year 2030 conditions.

For purposes of this study, 8.03 MGD as the 2030 yield available from Bardwell Lake is only 93.7% of the currently authorized diversion of 8.57 MGD. A 5-foot raising of the Bardwell Lake normal water level increases the 2030 yield to only 10.45 MGD (interpolated), which is approximately 22% larger than the currently authorized diversion. The City of Ennis has expressed a direct interest in obtaining any additional water which could be developed from Bardwell Lake.

The issues remaining would therefore consist of payment of construction cost for the modification. Additionally, it is noted that none of the firm yields for Bardwell Lake which were determined by the USCE consider upstream or downstream water rights. Consideration of such water rights may impact the yield of Bardwell Lake to the point where even with the 5-foot raising, the currently authorized diversions cannot be met.

TABLE 4-4

EFFECT OF BARDWELL LAKE ON FIRM YIELD
OF RICHLAND-CHAMBERS RESERVOIR

Assumed Bardwell Lake Normal Operating Level (ft msl)	Richland-Chambers Reservoir Firm Yield			
	1985 Conditions		2065 Conditions	
	(cfs)	(mgd)	(cfs)	(mgd)
421.0	336.7	217.6	264.5	171.0
426.0	335.9	217.1	264.5	171.0
429.0	335.4	216.8	264.5	171.0

Source: Unpublished preliminary draft report, USCE, Fort Worth District, 1988.

4.4.5.6 Terminal Storage Yield Analyses Performed by Fort Worth District, USCE

Pursuant to discussions with certain members of the Study Team, the Fort Worth District, USCE performed a series of preliminary yield analyses under the assumption that the raising of the conservation pool of Bardwell Lake by 5 feet would be coupled with use of the reservoir as a terminal storage facility. At a meeting on February 22, 1989, preliminary results were discussed with USCE staff. The assumptions used by USCE were:

1. The Bardwell Lake conservation pool would be raised 5 feet to elevation 426.0 ft msl.
2. Year 2065 sediment conditions were assumed.
3. Pumped inflows would be available only from October 1 through March 31 (six months).
4. All conservation storage not filled by natural runoff would be available to store pumped water.

The results of the USCE computer simulations were that use of Bardwell Lake for terminal storage would be very efficient. At an assumed pumped inflow rate of 35 cubic feet per second (cfs) or 22.6 MGD, the 2065-condition firm yield of Bardwell Lake would be increased from 8.9 MGD to 19.3 MGD, or an increase of 10.4 MGD. Unfortunately, the USCE model does not allow the determination of the total pumped volume. If it is assumed, however, that the maximum 1-year pumped volume is equivalent to 35 cfs over the October 1-March 31 time period, then this amounts to 11.3 MGD. Losses in a year in which no spills occurred would thus amount to only 0.9 MGD, or 8.0% of the pumped volume. Greater losses can be expected in other years, i.e., when flood runoff causes refilling of the reservoir and spilling of pumped water.

4.5 REFERENCES

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5.0 WATER, TRANSMISSION, TREATMENT AND DISTRIBUTION

5.1 DESCRIPTION OF EXISTING FACILITIES

The current water demands in the Study Area are provided from surface water and groundwater systems. These systems are discussed in the following sections.

5.1.1 Surface Water Systems

There are three surface water systems that supply water to Study Area residents. These systems include the Ellis County Water Control and Improvement District No. 1, the City of Ennis, and the Midlothian Water District.

5.1.1.1 Waxahachie

In December 1954 the Ellis County Water Control and Improvement District No. 1 (ECWCID No. 1) was formed to provide a surface water supply for the City of Waxahachie. In 1956, Waxahachie Lake was constructed on South Prong of Waxahachie Creek south of the City. The 13,800 acre-foot, single-purpose reservoir has been permitted by the TWC for diversions of 3.19 MGD (3570 acre-feet per year). In 1972 the ECWCID No. 1 contracted with the TRA to divert 3.86 MGD of additional supply from Bardwell Lake. This multi-purpose reservoir on Waxahachie Creek southwest of the City of Waxahachie was completed by the Corps of Engineers in 1965. Since then, the ECWCID No. 1 has constructed a pump station at Bardwell Lake and a pipeline to transfer water from Bardwell Lake to Waxahachie Lake where it is conveyed to the water treatment plant and then introduced into the water distribution system. The current capacity of the water treatment plant is 7.0 MGD and it utilizes conventional processes of sedimentation, filtration and disinfection with aeration for odor and taste enhancement. Plans are currently in process to expand the plant by an additional 5.0 MGD which will provide a total capacity of 12.0 MGD.

5.1.1.2 Ennis

The City of Ennis entered into a contract with the TRA to obtain 4.71 MGD of surface water supply from Bardwell Lake in the mid-1960s. This surface water supply is conveyed about 1 mile to the City's water treatment plant, which was built in 1966, and then introduced into the City's distribution system. The water treatment plant's current capacity is 6.0 MGD, and the plant utilizes conventional processes of sedimentation, filtration and disinfection with aeration for odor and taste enhancement.

5.1.1.3 Midlothian

In 1976 the Midlothian Water District (MWD) was formed to supply surface water to the City of Midlothian. The MWD entered into a contract with the TRA to obtain up to 5.95 MGD of surface water supply from Joe Pool Lake, a multi-purpose project constructed on Mountain Creek by the Corps of Engineers, which was completed in 1986. The MWD has recently constructed an intake structure and raw water pumping station at Joe Pool Lake as well as a 24,400 foot long raw water conveyance line and a water treatment plant some 4 miles north of the City of Midlothian. The MWD conveys treated water to the City's distribution system. The current capacity of the MWD water treatment plant is 3.0 MGD. This plant utilizes conventional processes of sedimentation, filtration, and disinfection with aeration for odor and taste enhancement.

5.1.2 Groundwater Systems

Seven of the municipal study participants, namely Ferris, Italy, Maypearl, Milford, Palmer, Red Oak and Wilmer, are dependent on groundwater. Four water supply corporations study members are also dependent on groundwater. The fifth water supply corporation member, East Garrett Water Supply Corporation, obtains its water supply from the City of Ennis which has a surface water supply source as discussed above.

In addition to the above systems which are study members, the study area also includes 17 other non-profit water supply corporations and 16 small incorporated cities which depend on groundwater supplies. As discussed in Section 3.0, the 12 study members not having a surface water supply have recognized the inadequacy of their groundwater supply and have requested that their present groundwater systems be replaced or supplemented with a regional surface water supply. The 33 other groundwater systems in the study area are likely experiencing problems similar to those experienced by the study members and would probably also be favorable toward an adequate regional surface water supply to support their local system needs.

The study has evaluated the raw water conveyance and treatment facilities of the existing surface water systems which could be used in a regional system. Additionally, the study addresses the conveyance of treated water to the entities to be served but does not evaluate the individual distribution systems of the study participants. The individual distribution systems will not become a part of the regional system. The individual distribution systems will be maintained and operated by the individual local entities to deliver treated water to the ultimate user. However, it is proposed that the existing raw water conveyance and water treatment facilities in addition to the proposed regional treated water conveyance system will be maintained and operated by a regional entity to deliver treated water to the individual local entity for their distribution.

5.2 REGIONAL WATER SUPPLY SYSTEM DESIGN CRITERIA

The "Rules and Regulations for Public Water Systems" published by the Texas Department of Health Water Hygiene Division, were used in developing the regional water supply system design criteria. The State publication establishes minimum standardized public health design criteria and minimum acceptable operating practices for properly designed facilities constructed and operated to produce and distribute a safe potable water. The following conceptual design criteria has been developed for the regional water supply system based on this document and other accepted engineering practices.

Year	Projected peak regional requirements (MGD)	Existing regional capacity (MGD)	Projected expansion (MGD)
1990	22.1	16.0	6.14
2000	30.18	16.0	14.18
2010	41.58	16.0	25.58
2020	55.84	16.0	39.84
2030	69.80	16.0	53.80

The service areas of each of the three regional water treatment plants will be a function of the raw water supply source(s) to serve each system and the amount of treated water required for each service area. Those requirements will be described in more detail in Section 5.4 below. The distribution of the service areas and customer entities was optimized based on size and location of treatment plants and projected water supply requirements of the customer entity, their locations and treated delivery pipeline requirements. As an alternate to the Midlothian plant, the TRA Lakeview Regional WTP could be utilized if preferred by the study participants, and if negotiated with other Contracting Parties of that system.

5.4 REGIONAL SERVICE SYSTEM ALTERNATES

5.4.1 Alternate No. 1 - TCWCID No. 1 and Terminal Storage

The proposed raw water supply source for Alternate No. 1 is the Tarrant County Water Control and Improvement District No. 1 (TCWCID No. 1) pipeline system which crosses Ellis County from the southeast to northwest as it conveys raw water from the Cedar Creek and Richland Chambers Reservoirs to primary customers in the Tarrant County area. This TCWCID No. 1 conveyance system currently includes two pipelines which can convey up to 286 MGD of raw water to Tarrant County.

The TCWCID No. 1 has indicated a willingness to sell raw water to a regional entity selected to serve the Study Area. The TCWCID No. 1 has also indicated that terminal storage should be provided in Ellis County to minimize raw water delivery requirements during peak

demand periods for deliveries to Tarrant County. Therefore, on this premise, proposed terminal storage would be provided at Joe Pool Lake for the Midlothian Water Treatment Plant and service area, at Waxahachie Lake for the Waxahachie Treatment Plant and service area, and at Bardwell Lake for the Ennis Water Treatment Plant and service area.

In order to minimize impact on the operation of the existing reservoir projects, an amount of terminal storage for each lake was established which was equivalent to about 3 feet or less of reservoir fluctuation at normal pool level. Therefore, utilizing this mode of operation, raw water would be delivered to the treatment plant/reservoir during the off-peak season of October 1 through March 31 at a rate equivalent to about twice the annual average demand. During this period the water treatment plants were assumed to process about one-half of the incoming raw water, with the rest going into the terminal storage reservoir. During the TCWCID No. 1 peak demand season (April 1 through September 30), raw water deliveries will be reduced and most of the raw water required for treatment plant operation would be from stored waters in the respective terminal storage reservoir. The use of the existing reservoirs would likely involve the payment of a fee for use of the storage capacity. A preliminary conceptual reservoir storage use fee has been developed for each of the three terminal storage reservoirs based on the percentage of the total conservation storage capacity of the reservoir which is required for terminal storage for each treatment plant service area. Also, additional raw water would be is purchased to compensate for additional evaporation losses from the terminal storage reservoirs. Each of these factors are considered in the development of costs for Alternate No. 1.

The following user entities were assigned to each of the three water treatment plant service areas on the basis of terminal storage available for each treatment plant and projected water supply requirements for each user entity for Alternate No. 1.

Midlothian Service Area	Waxahachie Service Area	Ennis Service Area
Midlothian	Waxahachie	Ennis/East Garrett
Red Oak	Italy	Boyce
Rockett	Milford	Palmer
Buena Vista		Bristol
Maypearl		Ferris
SSC		Wilmer

The quantity and percent of the study area projected water supply deficits are given in Table 5-1 for each service area for the planning year 1990, 2000, 2010, 2020, and 2030 for Alternate No. 1. The deficits reflect the quantity of new water required in addition to existing supplies to meet the needs of each service area.

The projected cost of raw water to be purchased from the TCWCID No. 1 has been developed for this study from the best available information at this time which is a study performed in 1983. The 1983 study projected the costs of water for the period through 2013. The projected costs in that study included inflation for the future years. In order for the costs to be consistent with other costs used for this project, the 1983 study values were adjusted to 1989. These 1983 adjusted values are used in this project for raw water cost through the year 2010. Raw water costs for the period after 2010 are not available from TCWCID No. 1, therefore a preliminary estimated cost has been used for this future time period. The TCWCID No. 1 is currently developing a system cost model to develop future costs of raw water. Additionally, the TCWCID No. 1 is performing a Long Range Water Supply Study to determine future water supplies required to meet the demands of its customers. Information from these efforts should be available by late 1989.

A conveyance network schematic for Alternate No. 1 is included as Figure 5-1. The pipeline system includes some 15 miles of raw water delivery pipelines tapping the TCWCID No. 1 pipeline system at three locations as shown and some 100 miles of treated water conveyance pipelines. The pipeline routes will generally follow established right-of-ways of roadways

Table 5-1

TABLE 5-1

ALTERNATE NO. 1
PROJECTED DEFICIT WATER SUPPLY REQUIREMENTS BY SERVICE AREA

Service area	1990		2000		2010		2020		2030	
	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)
Midlothian Plant	1.90	61	2.06	54	3.96	57	6.86	53	9.71	51
Waxahachie Plant	0.32	10	0.48	13	0.69	10	2.02	16	3.34	18
Ennis Plant	0.91	29	1.26	33	2.33	33	4.06	31	5.01	31
Total	3.13	100	3.80	100	6.98	100	12.95	100	18.86	100

Def. = Deficit - new water required.
Dist. = Distribution of service area new water requirements.

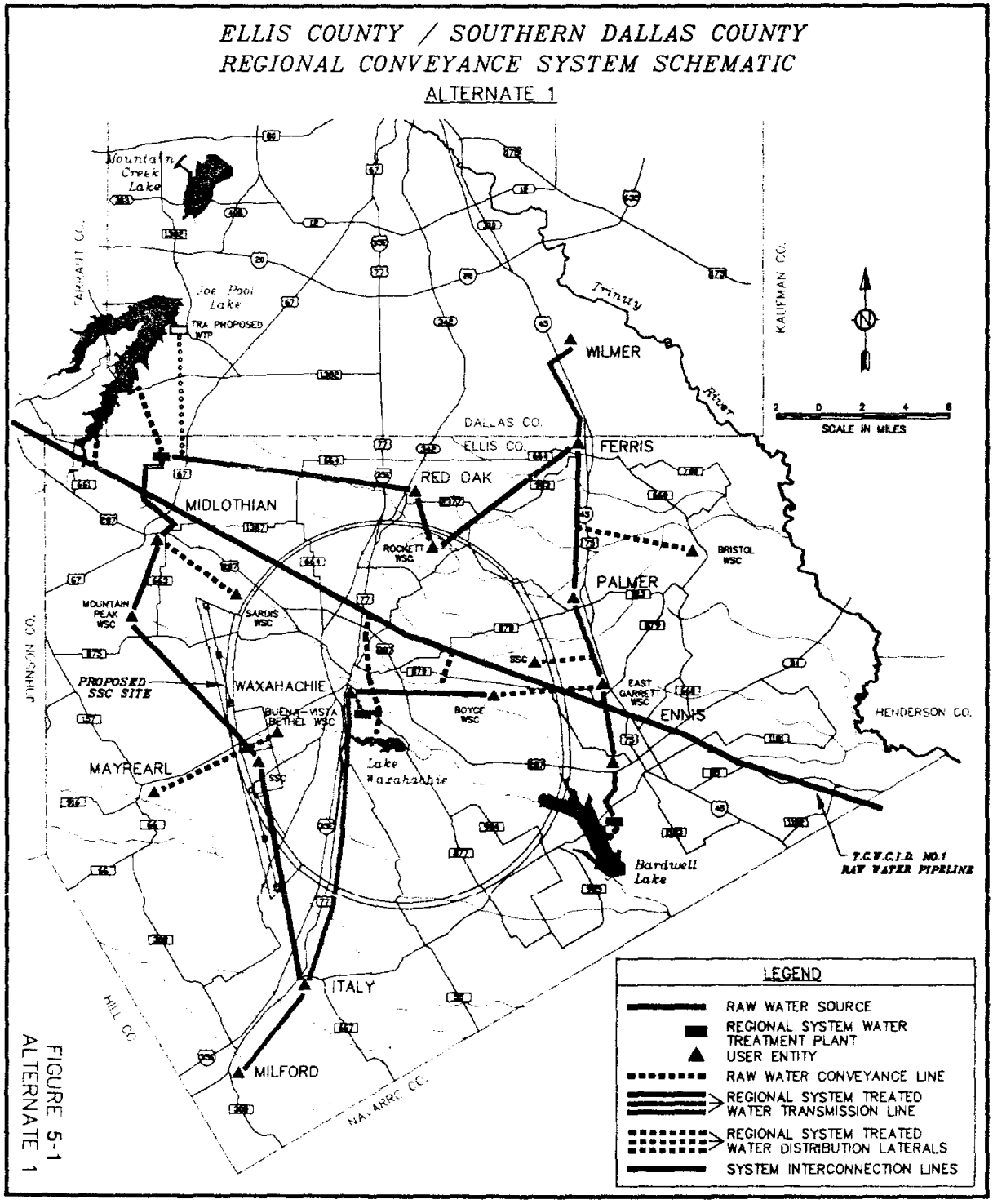


FIGURE 5-1
ALTERNATE 1

or railroads and/or other utility corridors to minimize disturbance of areas through which the pipelines extend.

5.4.2 Alternate No. 2 - Italy Reservoir

The proposed raw water supply source for Alternate No. 2 would be the proposed Italy Reservoir as discussed in Section 4.0. This project assumes that the proposed Italy Reservoir could not be completed before the year 2000. During the interim period between 1990 and 2000, it is proposed that the water required for the study area be obtained from the TCWCID No. 1 using the terminal storage concept presented in Alternate No. 1.

For this alternate, the following user entities were assigned to each of the three water treatment plant service areas.

Midlothian Plant Service Area	Waxahachie Plant Service Area	Ennis Plant Service Area
Midlothian	Waxahachie	Ennis/East Garrett
Red Oak	Italy	Boyce
Rockett	Milford	Palmer
	SSC	Bristol
	Maypearl	Ferris
	Buena Vista	Wilmer

The quantity and percentage of the study area projected water supply deficits are given in Table 5-2 for each service area for the planning years 1990, 2000, 2010, 2020, and 2030 for Alternate No. 2.

The projected probable cost of raw water from the proposed Italy Reservoir is based on updating costs from a 1972 study performed for the TRA. The 1972 costs include only reservoir construction and land and do not provide allowance for senior downstream water rights of TCWCID No. 1 at the Richland Chambers Reservoir or for related environmental impacts of major reservoir development. These additional requirements have been considered in the alternate evaluation process described in Section 5.6. The projected costs also assume that the

TABLE 5-2

ALTERNATE NO. 2
PROJECTED DEFICIT WATER SUPPLY REQUIREMENTS BY SERVICE AREA

Service area	1990		2000		2010		2020		2030	
	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)
Midlothian Plant	-	0	-	0	1.68	24	4.34	34	6.91	37
Waxahachie Plant	2.22	71	2.54	67	2.97	43	4.56	35	6.14	32
Ennis Plant	0.91	29	1.26	33	2.33	33	4.06	31	5.81	31
Total	3.13	100	3.80	100	6.98	100	12.95	100	18.86	100

Def. = Deficit - new water required.
Dist. = Distribution of service area new water requirements.

safe yield of the reservoir in addition to that required for the study area will be sold to others. Therefore, costs to the proposed regional system will be proportional to only the study area demand.

A conveyance network schematic for Alternate No. 2 is included as Figure 5-2. The pipeline system includes some 70 miles of raw water delivery pipeline as well as intake facilities at the proposed Italy Reservoir and some 125 miles of treated water conveyance pipelines.

5.4.3 Alternate No. 3 - Italy Plus Upper Red Oak Reservoir

The proposed raw water supply sources for Alternate No. 3 would be the proposed Italy and Upper Red Oak Reservoirs as discussed in Section 4.0. This project assumes that the proposed Italy and Upper Red Oak Reservoirs could not be completed before the year 2000. During the interim period between 1990 and 2000, it is proposed that the water required for the study area be obtained from the TCWCID No. 1 using the terminal storage concept presented in Alternate No. 1. It should be noted that construction of the Superconducting Super Collider could prevent the construction of the Upper Red Oak Reservoir.

For this alternate, the following user entities were assigned to each of the three water treatment plant service areas.

Midlothian Service Area	Waxahachie Service Area	Ennis Service Area
Midlothian	Waxahachie	Ennis/East Garrett
Red Oak	Italy	Boyce
Rockett	Milford	Palmer
	SSC	Bristol
	Maypearl	Ferris
	Buena Vista	Wilmer

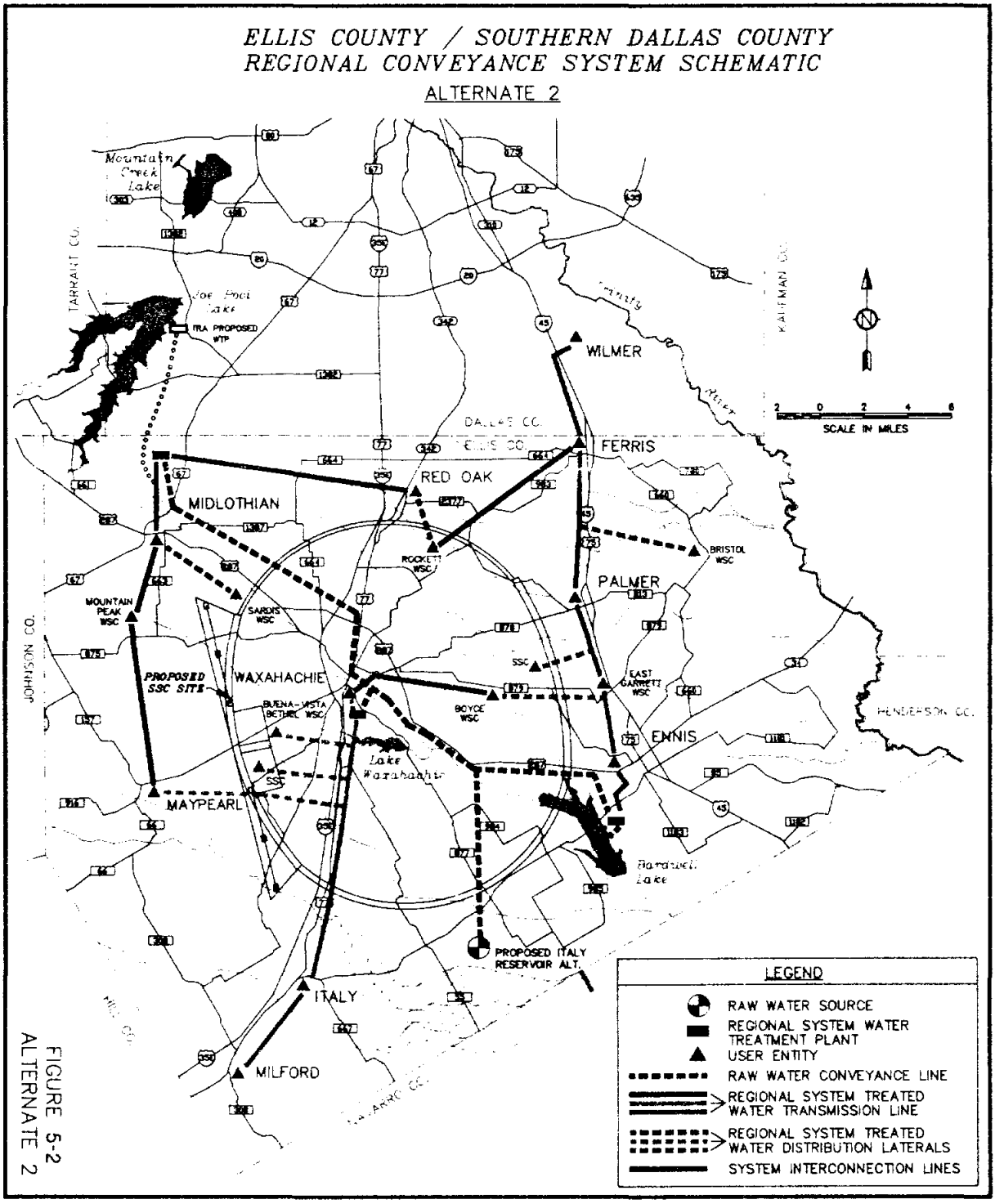


FIGURE 5-2
ALTERNATE 2

The quantity and percentage of the study area projected water supply deficits are given in Table 5-3 for each service area for the planning years 1990, 2000, 2010, 2020, and 2030 for Alternate No. 3.

A conveyance network schematic for Alternate No. 3 is included on Figure 5-3. The pipeline system includes some 85 miles of raw water delivery pipelines as well as intake facilities Figure 5-2 at the proposed Italy and Upper Red Oak Reservoirs and some 125 miles of treated water conveyance pipelines.

The projected cost of raw water from the proposed Italy Reservoir is based on the same conditions as for Alternate No. 2. The projected cost of raw water from the proposed Upper Red Oak Reservoir is based on recent engineering studies performed for the Rockett Water Supply Corporation with costs updated to 1989.

5.4.4 Alternate No. 4 - Wastewater Reuse Plus Upper Red Oak and Italy

The proposed water supply sources for Alternate No. 4 would be effluent from the TRA Central Wastewater Treatment Plant as well as diversions from Joe Pool Lake exchanged for effluent utilized for required downstream releases to Mountain Creek Lake; diversion from the Upper Red Oak Reservoir which would also develop effluent flows from the proposed Red Oak Regional Wastewater Treatment Plant; and diversions from the Italy Reservoir which would be used to maintain a minimum freshwater/reuse water blend in Waxahachie Creek of less than 30 percent. This alternate would also include a fourth water treatment plant near the Upper Red Oak Reservoir and, accordingly, a fourth service area. However, as discussed in Section 4.0, wastewater reuse to supplement potable water supplies is not yet conventionally utilized, and several precautions including advanced waste treatment should be considered for this alternate. This project assumes that the proposed Upper Red Oak and Italy Reservoirs could not be completed before the year 2000. During the interim period between 1990 and 2000, it is proposed that the water required for the study area be obtained from the TCWCID No. 1 using the terminal storage concept presented in Alternate No. 1. It should be noted that construction

TABLE 5-3

ALTERNATE NO. 3
PROJECTED DEFICIT WATER SUPPLY REQUIREMENTS BY SERVICE AREA

Service area	1990		2000		2010		2020		2030	
	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)
Midlothian Plant	-	0	-	0	1.68	24	4.34	34	6.91	37
Waxahachie Plant	2.22	71	2.54	67	2.97	43	4.56	36	6.14	32
Ennis Plant	0.91	29	1.26	33	2.33	33	4.06	31	5.81	31
Total	3.13	100	3.80	100	6.98	100	12.95	100	18.86	100

Def. = Deficit - new water required.
Dist. = Distribution of service area new water requirements.

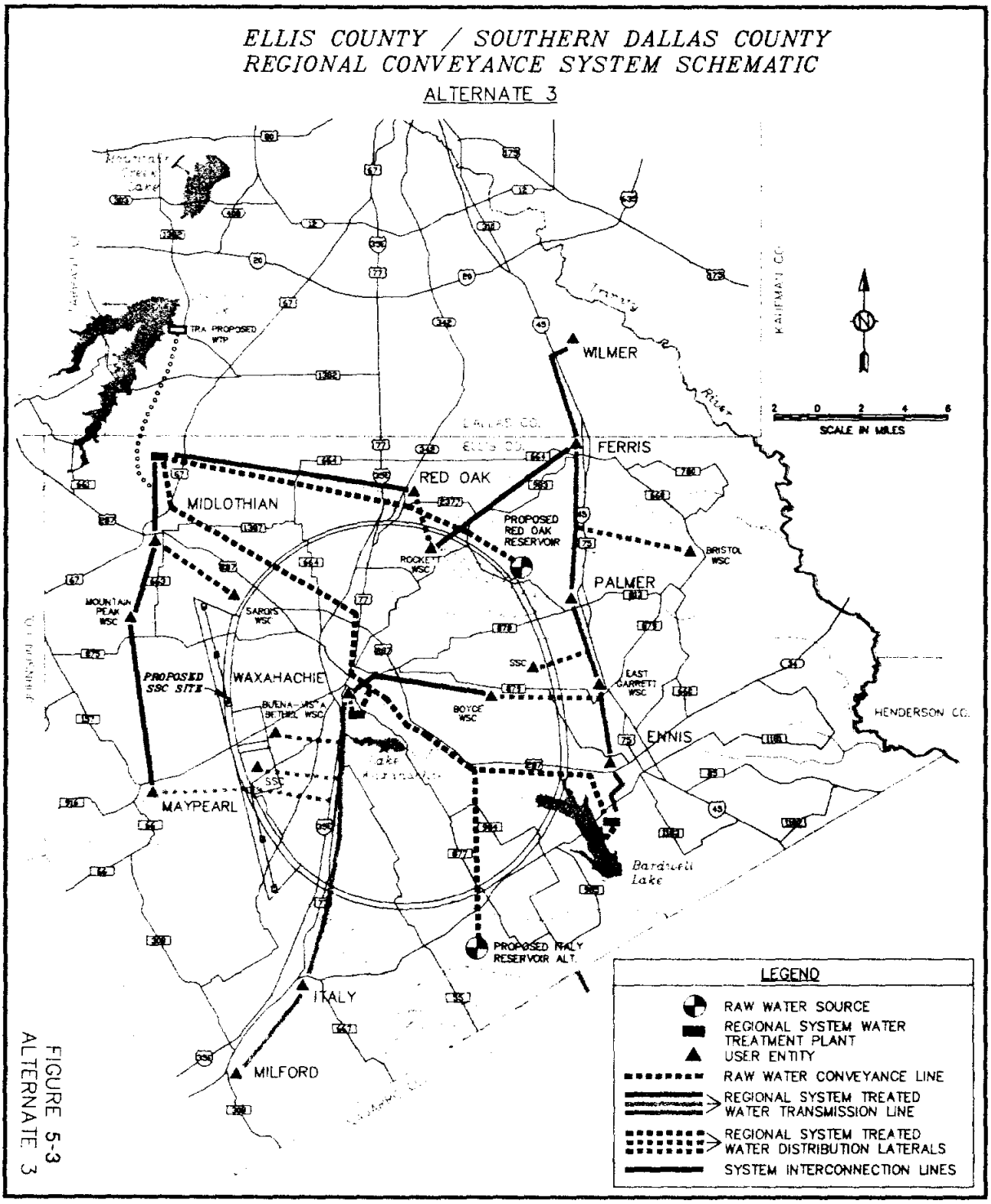


FIGURE 5-3
ALTERNATE 3

of the Superconducting Super Collider could prevent the construction of the Upper Red Oak Reservoir.

For this alternate, the following user entities were assigned to each of the four water treatment plant service areas.

Midlothian Service Area	Waxahachie Service Area	Ennis Service Area	Red Oak Service Area
Midlothian	Waxahachie	Ennis/East Garrett	Red Oak
Buena Vista	Italy	Boyce	Rockett
Maypearl	Milford	Palmer	
	SSC	Bristol	
		Ferris	
		Wilmer	

The quantity and percentage of the study area projected water supply deficits are given in Table 5-4 for each service area for the planning years 1990, 2000, 2010, 2020, and 2030 for Alternate No. 4.

A conveyance network schematic for Alternate 4 is included as Figure 5-4. The pipeline system includes some 125 miles of raw water delivery pipelines and intakes at the proposed Italy and Upper Red Oak Reservoirs as well as some 115 miles of treated water conveyance pipelines. The projected cost of raw water from the proposed Italy and Upper Red Oak Reservoirs is the same as for Alternate No. 3. The cost of purchasing the TRA Central Wastewater Treatment Plant effluent is based on the current charges of $0.25 per 1000 gallons for reclaimed wastewater plus an allowance of $1 per 1000 gallons to cover tertiary treatment potentially required for reuse of the wastewater. This factor is considered in the alternate systems evaluation described in Section 5.6.

TABLE 5-4

ALTERNATE NO. 4
PROJECTED DEFICIT WATER SUPPLY REQUIREMENTS BY SERVICE AREA

Service area	1990		2000		2010		2020		2030	
	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)
Midlothian Plant	0.32	10	0.48	13	0.70	10	0.96	7	1.22	6
Waxahachie Plant	1.90	61	2.06	54	2.27	3	3.60	28	4.92	26
Ennis Plant	0.91	29	1.26	33	2.33	33	4.05	31	5.81	31
Red Oak Plant	0	0	0	0	1.68	24	4.34	34	6.91	37
otal	3.13	100	3.80	100	6.98	100	12.95	100	18.86	100

Def. = Deficit - new water required.
Dist. = Distribution of service area new water requirements.

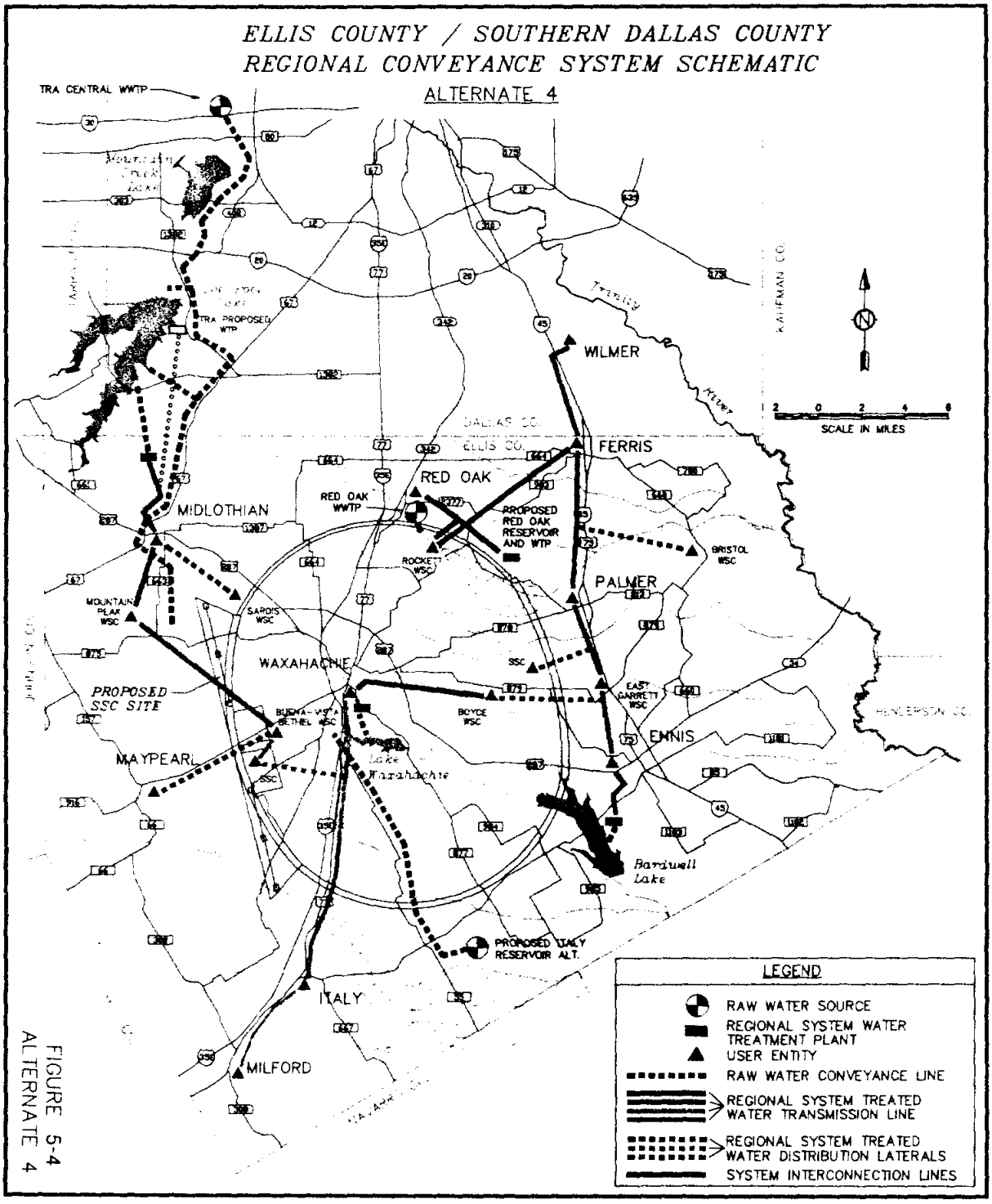


FIGURE 5-4
ALTERNATE 4

5.4.5 Alternate No. 5 - Wastewater Reuse Plus Lower Red Oak and Bear Creek Reservoirs

The proposed raw water supply sources for Alternate No. 5 are the TRA Central Wastewater Treatment Plant effluent and the Lower Red Oakand Bear Creek Reservoirs which will also develop effluent from the proposed upstream Red Oak Regional Wastewater Treatment Plant. Similar precautions for wastewater reuse for supplementing potable water supplies to those considered for Alternate No. 4 should also be considered for this alternate. This project assumes that the proposed Lower Red Oak and Bear Creek Reservoirs could not be completed before the year 2000. During the interim period between 1990 and 2000, it is proposed that the Table 5-4 water required for the study area be obtained from the TCWCID No. 1 using the terminal storage concept presented in Alternate No. 1.

For this alternate, the following user entities would be served by each of the three regional water treatment plants:

Midlothian Service Area	Waxahachie Service Area	Ennis Service Area
Midlothian	Waxahachie	Ennis/East Garrett
Red Oak	Italy	Boyce
Rockett	Milford	Palmer
	SSC	Bristol
	Maypearl	Ferris
	Buena Vista	Wilmer

The quantity and percentage of the study area projected water supply deficits are given in Table 5-5 for each service area for the planning years 1990, 2000, 2010, 2020, and 2030 for Alternate No. 5.

A conveyance network schematic for Alternate No. 5 is included as Figure 5-5. The pipeline system includes some 60 miles of raw water delivery pipelines and an intake at the proposed Lower Red Oak and Bear Creek Reservoirs as well as some 125 miles of treated water conveyance pipelines.

TABLE 5-5

ALTERNATE NO. 5
PROJECTED DEFICIT AND WATER SUPPLY REQUIREMENTS BY SERVICE AREA

Service area	1990		2000		2010		2020		2030	
	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)	Def. (MGD)	Dist. (%)
Midlothian Plant	-	0	-	0	1.68	24	4.34	34	6.91	37
Waxahachie Plant	2.22	71	2.54	67	2.97	43	4.56	35	6.14	32
Ennis Plant	0.91	29	1.26	33	2.33	33	4.05	31	5.81	31
Total	3.13	100	3.80	100	6.98	100	12.95	100	18.86	100

Def. = Deficit - new water required.
Dist. = Distribution of service area new water requirements.

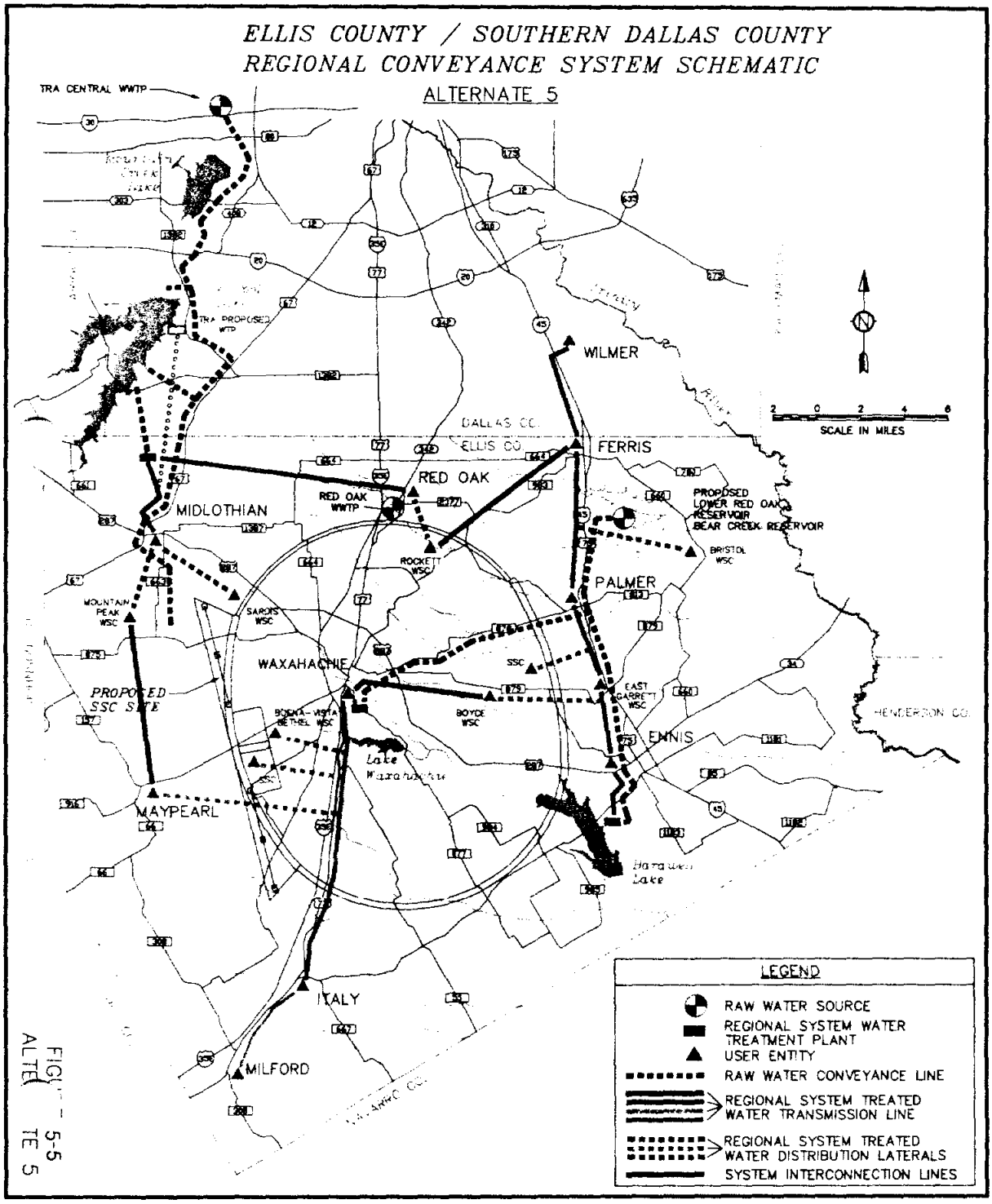


FIGURE 5-5
ALTERNATE 5

The projected cost of raw water from the Bear Creek and Lower Red Oak Reservoirs is based on prior engineering studies done in 1978 for TRA and updated to present costs. However, these costs may not include adequate allowance for related environmental impacts of major reservoir development. The cost of purchasing the TRA Central Wastewater Treatment Plant effluent is based on the current charges of $0.25 per 1000 gallons for reclaimed wastewater plus an allowance of $1 per 1000 gallons to cover tertiary treatment potentially required for reuse of the wastewater. This factor is considered in the alternate systems evaluation described in Section 5.6.

5.5 PROBABLE COSTS OF ALTERNATE SYSTEMS

The probable unit costs of water that would be incurred in each 10-year increment from 1990 through 2030 were developed based on initially constructing the system elements sized to meet 2010 water demands and then expanding in 2010 to meet the 2030 demands. The costs presented in this report section are comparative costs and serve as the basis for identifying the most economical system.

5.5.1 Basis of Estimated Costs

The estimated costs for the construction of facilities and for the annual operation and maintenance have been developed using the following generalized cost and criteria:

- Annual debt service for proposed pipelines and water treatment facilities is based on payment at an interest rate of 8.5 percent for 20 years.

- Annual debt service for proposed reservoirs is based on payment at an interest rate of 8.5 percent for 40 years.

- A reservoir storage space use fee for terminal storage required for Alternate No. 1 and for Alternate Nos. 4 and 5 (e.g., TRA Central effluent) was based upon a proportional share of cost currently paid by reservoir users.

- The Regional System will assume the debt service of existing facilities including water treatment plants and raw water delivery facilities that are proposed to become part of the Regional System.

- Capital costs for equity purchase of existing facilities have not been included in these cost projections, at this time.

- The Regional System would assume the local share of costs for the proposed modifications to Bardwell Lake.

- The construction cost for expansions of the water treatment plants is $0.80 per million gallons of plant capacity.

- The Regional System would pay for evaporation losses that are in addition to current losses incurred in reservoirs used for terminal storage.

- The cost of raw water, delivered by the existing pipelines, to be purchased from the TCWCID No. 1 is shown on Table 5-6.

- The cost of Richland Creek Reservoir raw water which would be captured in the proposed Italy Reservoir by a transfer of water rights is based on $0.40 per 1000 gallons. It should be noted that this cost will probably be significantly greater than $0.40 since that amount is based on cost for an existing reservoir. The TCWCID No. 1 will probably value this water on a replacement cost, if this approach is implemented.

- The construction cost of pump stations was based on $750 per horsepower.

- Pipeline right-of-way costs were based on $25,000 per mile or about $10,000 per acre.

TABLE 5-6

TCWCID NO. 1 PROJECTED RAW WATER PURCHASE COSTS

Year	Projected Probable Raw Water Cost ($/1,000 gallons)[1]
1990	$0.69
2000	0.69
2010	0.85
2020	0.90[2]
2030	0.90[2]

[1] Projected costs for 1990-2010 based upon estimates performed by TCWCID and are presented in 1979 constant dollars.

[2] The costs shown for the years represent a preliminary estimate of costs since data are not available from TCWCID No 1. Projected costs of water will not be available from TCWCID No. 1 until late 1989.

- o Pipeline construction costs were based on about $2.10 per inch-diameter per linear foot.
- o The cost for the TRA Central effluent will be based upon $1.25 per 1000 gallons which includes a basic commodity charge of about $0.25 per 1000 gallons for reclaimed wastewater plus an allowance of $1 per 1000 gallons to cover tertiary treatment potentially required for reuse of the wastewater.

- o The operation and maintenance costs for the water treatment plants is based upon $0.55 per 1000 gallons for plant size ranges utilized in this study.

- o The operation and maintenance costs for pipelines and pumping stations were based on 1 percent of the capital costs of the pipelines and 3 percent of the capital cost of the pumping stations, respectively.

- o The operation and maintenance costs for the reservoirs are based upon 0.2 percent of the capital costs of the reservoir.

- o The electrical power costs for pumping energy requirements was based on $0.08 per kwh.

5.5.2 Capital Costs

For each of the five candidate alternates described in Section 5.4, projected capital costs were developed which included raw water reservoir costs, raw water pipeline and pump station delivery costs, water treatment plant costs, treated water conveyance pipeline and pump station costs, and interconnection pipeline costs. These costs also included right-of-way and land costs as well as construction, administration, engineering, and financing contingencies. The probable capital costs for each alternate for each decade during the planning study for the facilities scheduled to be installed that year are shown in Table 5-7. A more detailed break-down of these capital costs is included in the Appendix.

TABLE 5-7

REGIONAL SYSTEM PROBABLE CAPITAL COSTS FOR ALTERNATIVES
($1,000)

Alternate No.	Period 1990	2000	2010	2020	2030	Total
1	42,444	12,926	51,356	17,700	210	124,636
2	45,013	77,797	52,495	31,189	3,354	209,848
3	46,120	91,884	54,651	34,639	2,352	229,646
4	46,221	71,264	61,838	26,786	617	206,726
5	43,858	110,871	67,579	31,205	5,085	258,598

The probable capital costs of the five evaluated alternates varies from about $124,636,000 for Alternate No. 1 to about $258,598,000 for Alternate No. 5. The capital cost of Alternate No. 1 is less than 60 percent of the next costly alternate, which is Alternate No. 3.

5.5.3 Annual Costs

The annual costs have been projected for each of the five alternates for each decade during the planning period. A summary of these annual costs (both debt and O&M) is presented in Table 5-8. For 1990, the projected annual costs for the five alternates vary from $11,578,000 (Alternate No. 1) to $12,639,000 (Alternate No. 4). This annual cost increases by the year 2030 to a range from $23,916,000 (Alternate No. 1) to $30,455,000 (Alternate No. 5).

5.5.4 Water Unit Costs by Year

The probable water unit costs that would be incurred in various years was developed based on initially constructing the facilities with capacity adequate to meet the year 2010 demands and then expanding the facilities in 2010 to meet the 2030 conditions.

Measures to reduce the initial 1990 costs including reducing design requirements to 2010 conditions and deferring the construction of interconnection lines and Bardwell Lake modification until 2010 were utilized in this analysis. The gross water demands for the study area have been used to compute the unit costs in Table 5-9 since the total annual costs include assumption of existing facility debt service by the regional entity in the future operation of the regional system. The 1990 to 2000 period cost of Alternate No. 1 ranges from $2.54 to $2.87 per 1000 gallons and is the lowest on this basis.

5.5.5 Ranking of Alternates

Ranking of the five candidate alternates is summarized in the Evaluation Matrix shown in Table 5-10. Selection of the most desirable alternate should not be based on economics alone. Therefore, a rating system based on alternate evaluation and analysis utilizing engineering

TABLE 5-8

REGIONAL SYSTEM ANNUAL PROBABLE COST
FOR EACH ALTERNATIVE
($1,000)

Alternative No.	Year				
	1990	2000	2010	2020	2030
1	11,578	13,979	17,415	19,455	23,916
2	11,884	20,496	23,232	24,360	27,424
3	11,997	21,899	24,445	26,464	29,078
4	12,639	20,395	22,968	22,645	24,579
5	12,574	23,463	27,603	27,603	30,455

TABLE 5-9

REGIONAL SYSTEM PROBABLE UNIT COSTS OF WATER FOR ALTERNATES

($/1,000 Gallons)

Alternate No.	Period			
	1990-2000	2000-2010	2010-2020	2020-2030
1	2.87 - 2.54	2.54 - 2.29	2.29 - 1.91	1.91 - 1.88
2	2.94 - 3.72	3.72 - 3.06	3.06 - 2.39	2.39 - 2.15
3	2.97 - 3.98	3.98 - 3.22	3.22 - 2.60	2.60 - 2.28
4	3.13 - 3.70	3.70 - 3.03	3.03 - 2.22	2.22 - 1.93
5	3.11 - 4.26	4.26 - 3.64	3.64 - 2.71	2.71 - 2.39

TABLE 5-10

REGIONAL WATER SUPPLY ALTERNATIVES

SUMMARY EVALUATION MATRIX

Alternate No.	Raw Water Source	Source Development[1]	Permitting Requirements[2]	Treatment Requirements[3]	Cost Ranking[4] Capital	Cost Ranking[4] Annual	Source Location/ Local Recreation Potential[5]	Composite Rating[6]
1	Existing Reservoirs: TCWCID No. 1 pipeline with terminal storage	1	1	1	1	1	3	8
2	New Reservoir: Italy	2	3	1	3	3	2	14
3	New Reservoirs: Italy/ Upper Red Oak	3	2	1	4	4	1	15
4	New Reservoirs/Reuse: TRA Central/Red Oak WWTP's	3	2	2	2	2	1	12
5	New Reservoirs/Reuse: Lower Red Oak/Bear Creek TRA Central/Red Oak WWTP's	2	2	2	5	5	1	18

[1]Source Development Difficulty:
0 - minimum difficulty
1 - minor difficulty
2 - moderate difficulty
3 - significant difficulty

[2]Permitting Requirements:
0 - minimum
1 - standard permit
2 - more complex
3 - most complex

[3]Treatment Requirements:
1 - conventional surface water treatment
2 - some additional treatment for reuse

[4]Cost ranking based on facilities required for 2030 conditions.

[5]Source Location/Local Recreation Potential:
1 - facilities within county near larger communities
2 - portion of facilities within county near smaller communities
3 - facilities outside county

[6]Composite Rating:
9 - most desirable
18 - least desirable

TABLE 5-11

RECENT RESERVOIR PROJECTS

Project	Permit Application/ Authorization	Construction Start	Impoundment
Richland Chambers	1954	1983	1987
Joe Pool	1965	1975	1986
Ray Roberts	1965	1975	1987
Cooper*	1955	1985	(1992)

*Involved in prolonged lawsuit on lack of EIS.

and the permission to proceed would come only after regulatory agencies and public officials have been satisfied concerning the suitability of these alternatives. Opinions of cost have taken note of these factors. However, until the actual requirements for permitting design and construction can be determined, the actual cost cannot be precisely determined. Water quality requirements for an indirect potable reuse project are subject to the "moving target" syndrome.

6.0 INSTITUTIONAL ORGANIZATION AND FINANCING

6.1 OVERVIEW

In order to establish a regional water system that operates efficiently and economically, and provides quality service, it is necessary to select an institutional structure that can effectively represent the whole region's interest and allow the orderly development of facilities. The institution selected to manage the regional system should function under the guidance and direction of a Customer Advisory Committee.

Some general principles which would be common to any institutional structure should be summarized. The recommended requirements relate to type of service provided, rules for obtaining service, how customer rates should be set, water quality and conservation programs.

6.1.1 General Principles

1. The regional system should be financed from anticipated utility revenues secured with no direct taxation in order to avoid the possibility of those not using the system having to pay for the system.
2. The services to be supplied by the regional system would be the wholesale delivery of potable water to local participating entities who, in turn, would deliver to the ultimate user as a retail service.
3. Services would be rendered under terms of formally executed contracts.
4. The regional supplier, through the Advisory Committee, should establish reasonable rates and contract terms under which service can be obtained.
5. Annual rates and charges should be based on actual annual cost of service. The supplier should be responsible for establishing annual predicted water costs,

but provide for adequate participation, review, comment and guidance by all customer entities, through the Customer Advisory Committee.

6. Resale of water outside a contracting party's corporate boundaries or approved service area should be prohibited except by prior approval by a majority of the Advisory Committee.
7. Under the regional agency concept, it would be more acceptable to share equally all rights and privileges, to average the cost of all needed facilities equitably among participating entities.
8. To assure fairness in the distribution of responsibility and cost, the regional system should establish a connection and rate policy to encourage maximum participation during the start-up, and that would compensate charter participants for costs borne initially for the benefit of later participants.
9. Water conservation programs should be required and implemented by all customer entities.

6.2 AGENCY STRUCTURE

To effect a regional system, several types of existing structures are available to accomplish overall planning, implementation and operation. The factors to be considered in selecting a new entity to meet the water needs of Ellis County include, but are not limited to, the following:

1. Administration
   a. How is the entity to be governed.
   b. Should there be one entity or multiple entities, and what relationship will exist among multiple entities.
   c. Who appoints or elects the governing body or bodies.

2. Powers

   a. What is the contracting authority with public entities and/or private entities.

   b. Who is responsible for coordination.

   c. How will rates be established.

   d. What conditions of service will be applied to customers.

   e. What financing authority will be established for the entity(ies).

   f. What funding mechanisms will be established to meet operation, maintenance and debt obligation.

   g. Who will own and operate system facilities such as reservoirs, distribution system and treatment system.

   h. How will service areas and jurisdictions be established.

3. Accountability

   a. What relationships will exist between entities (if more than one entity required).

   b. What is the relationship between entity(ies) and other governmental bodies.

   c. What is the relationship between entity(ies) and customers other than governmental entities.

   d. What is the entity's(ies') relationship to State agencies.

   e. What is the entity's(ies') relationship to Federal agencies.

6.3 TYPES OF AGENCIES

There are several water agency types which have been applied in the State of Texas to provide drinking water to the general public. However, given the regional nature of the task

at hand, and the multi-jurisdictional nature of the service area under which these facilities will be developed, a certain few agency types become feasible. These include:

- o sub-regional system controlled by major cities;
- o a newly-created regional water authority to provide wholesale water service; or
- o utilization of an existing agency to provide wholesale water service.

A discussion of the types of agencies is contained below.

6.3.1 Sub-Regional System Controlled by Major Cities

For Ellis County, this structure would result in the Cities of Midlothian, Waxahachie and Ennis supplying wholesale water to themselves as well as customer entities in the region. Each of these cities currently maintains a contract for a supply reservoir, operates its own water treatment plant and provides distribution within its service area. It would be quite feasible to construct transmission piping to convey treated water to neighboring cities and water supply corporations. Each system would be basically stand-alone with respect to the others, with possible emergency interconnection among the sub-regional systems.

6.3.1.1 Administration

In a sub-regional system controlled by major cities, each sub-region would be governed by the city council of the controlling city, which of course would be elected by the voters within the city limits. The city council would appoint personnel to operate and maintain the treatment and transmission facilities.

6.3.1.2 Powers

A city has the power to contract for water sale with neighboring entities, such as the way Ennis currently provides treated surface water to the East Garrett Water Supply Corporation. A contract would be negotiated between the city and each neighboring entity. The city would be required to provide the water at a reasonable cost of delivery, which is an often disputed calculation, and one which has been the subject of much litigation nationally.

Cities would have the power to condemn land inside and outside their corporate limits for transmission facilities. Rate regulation would only be possible by appeal to the TWC or litigation. Financing mechanisms would be limited to those available to cities, and as frequently occurs in such arrangements, from up-front cash contributions from parties contracting to buy water from the Cities.

6.3.1.3 Accountability

The relationship between city-controlled sub-regions would be effectively no different than now exists between major cities and their wholesale customer cities or agencies. They may wish to enter into inter-local agreements to provide emergency water services or other desirable cooperative efforts.

The relationship between the city and the customer would be established in the contract as negotiated between the two parties. The relationship between the cities and the State and Federal governments would be as they now exist for the cities.

6.3.2 A Newly-Created Regional Water Authority to Provide Wholesale Water Service

It is probable that new State legislation would be the most effective way to create the type of agency required to plan, design, finance, acquire land, construct and operate the regional system. The structure of the agency would be specifically defined by the participants, the Texas Water Code and in the enabling legislation creating such an agency. The process of creating a new agency would take a minimum of two years, considering the time required to formulate, draft and actually process a bill through the Texas Legislature.

6.3.2.1 Administration

A newly-created water authority would likely be governed by a Board of Directors, with each entity appointing one local member. The Board would elect from among themselves a President, Vice President, Secretary and Treasurer.

6.3.2.2 Powers

A newly-created authority would have the power to contract with either public or private entities. The power of eminent domain could also be provided by the enabling legislation.

The agency would typically be set up to be non-profit, thereby setting rates calculated only to defray expenses. This agency would stipulate to the member entities the conditions of service for wholesale water supply.

The agency would have the ability to issue long-term or short-term debt and be eligible for financial assistance from the State or Federal government.

6.3.3 Utilization of Existing Agencies to Provide Wholesale Water Service

There are several entities currently in existence which could now, or by administrative or legislative amendment, perform the desired wholesale service, including the Tarrant County Water Control and Improvement District No. 1, the Ellis County Water Control and Improvement District No. 1, the Midlothian Water District and the Trinity River Authority. A brief description of each of these agencies follows.

The Tarrant County Water Control and Improvement District No. 1 was organized under the provisions of Article 16, Section 59 of the Texas Constitution. Typical powers for a water control and improvement district include:

1. the control, storage, preservation and distribution of its water and floodwater and the water of its rivers and streams for irrigation, power and all other useful purposes;
2. the reclamation and irrigation of its arid, semi-arid and other land which needs irrigation;
3. the reclamation, drainage, conservation and development of its forests, water and hydroelectric power;
4. the navigation of its coastal and inland water;
5. the control, abatement and change of any shortage or harmful excess of water;
6. the protection, preservation and restoration of the purity and sanitary condition of water within the state; and
7. the preservation and conservation of all natural resources of the state.

The Ellis County Water Control and Improvement District No. 1 was created in October 1954 and incorporated under the authority of Article 16, Section 59 of the Constitution of the State of Texas. This District was created for the purposes of controlling, storing, preservation and distribution of its water, the water of its lakes, rivers and streams for irrigation, the conservation and development of its water for domestic and municipal purposes, and the preservation of all such natural resources and the reclamation of the drainage of land of said District which may need draining. The District's boundaries basically correspond to the corporate limits of the City of Waxahachie. Also, the City of Ennis has statutory authority to provide wholesale water service to other communities and water districts.

The Midlothian Water District (MWD) was created by the 63rd Legislature (S.B. No. 538) of the State of Texas in 1973, as the territory contained within the corporate limits of the City of Midlothian. This District was created for the purpose of providing for a source of water supply for municipal, domestic, commercial and industrial use, and diverting, impounding, storing, treating and transporting the same. The District has the power to acquire, construct and operate water facilities.

The TRA was created by an Act of the 54th Legislature (H.B. No. 20) of the State of Texas in 1955. The Study Area is within TRA's legislatively established territory. The TRA Board consists of 24 directors appointed by the Governor from within the Trinity River Basin. Ellis County has maintained a directorship on the TRA Board of Directors since the creation of the Authority.

With any regional system, all regional facilities should be owned and operated by the Regional Agency, but their use would be pledged totally to the benefit of the contracting parties of the regional system. Distribution systems for retail sales and localized needs would be maintained by the existing owner or the retail provider.

6.3.3.1 Administration

An Advisory Committee should be established consisting of one member appointed by each participating entity, to operate under procedures and by-laws created and implemented by the Advisory Committee. The primary purpose of the Advisory Committee would be to:

- o consult with and advise the Regional Authority on all matters pertaining to regional system operation, maintenance and administration;
- o review and recommend approval of annual budgets;
- o review and recommend capital expenditures when system needs are identified.

The Advisory Committee concept has been used successfully on several regional projects throughout the State of Texas. In conjunction with advice and consent of the Advisory Committee, the Regional Authority would plan, design, construct, operate, maintain and manage the regional system in accordance with the terms of the regional contract.

6.3.3.2 Powers

The Regional Authority should contract with member entities to provide wholesale water services. Rates would be established based solely on the actual cost of service. The Regional Authority would need to have the power of eminant domain within the Study Area to expedite land and right-of-way acquisition.

6.3.3.3 Accountability

The functional relationship between the Regional Authority and the member entities should be through the Advisory Committee. The Advisory Committee, with the responsibility to

review and approve all matters pertaining to annual operating budgets, needed capital improvements and system policies, would provide directional control to achieve the region's specific interests. The Advisory Committee concept has worked effectively for several regional systems now in place.

6.4 ALTERNATIVE FINANCING METHODOLOGIES

Financing techniques that will be considered in the evaluation of financing options are described in this section. The two most common forms of conventional tax-exempt debt are general obligation and revenue bonds.

6.4.1 General Obligation Bonds

Among the advantages of general obligation debt are:

- Credit Strength--The securities are backed by the credit of the government entity. This usually is the strongest security pledge available to an issuer at the lowest effective interest cost.

- Relatively Simple Financing Option--The administration of general obligation bonds is simple and therefore somewhat less costly than other types of debt.

The primary disadvantage of general obligation debt is that voter approval is required for initial and all future system expansions. This process is likely to take a relatively long period of time, which could possibly delay work on the project. Regional systems throughout the State of Texas do not generally rely upon general obligation debt for water utility project financing.

6.4.2 Revenue Bonds

The second option is the issuance of revenue bonds, whereby the interest and principal are paid solely from the revenues generated from the regional system. The primary advantage of revenue bond financing is that its use tends to open up to the issuer a portion of the market that is not readily available when general obligation debt is employed.

Among the disadvantages of revenue bonds are:

- Higher Issuance Cost--Revenue bond financing is generally more complicated and, consequently, management fees, legal fees and consulting fees slightly increase the issuer's cost above the level which a tax-based (general obligation) issue would produce.

- Potentially Higher Interest Cost--Investors tend to require higher interest rates for conventional term revenue bonds which are not backed by a tax pledge.

6.4.3 Water Development Fund

Another financing alternative would be to obtain financing from the TWDB through the Water Development Fund (WDF), which can finance certain water supply projects, and which offers extremely competitive interest rates usually below those normally available to municipalities. The WDF is funded by the sale of State of Texas general obligation bonds. The bond proceeds are then used to purchase bond issues from political subdivisions and non-profit water supply corporations for water projects. As the political subdivision bonds are repaid to the Board, the general obligation bonds used to fund the program are repaid by the State. The program is

currently self-supporting. A copy of the rules relating to financial programs available through the TWDB is included in the Appendix.

6.5 RECOMMENDATIONS

- It is clear that the designation of only one regional entity has many advantages over the use of multiple entities. One agency should be responsible for developing the surface water supplies for the needs of the entire service area and for delivering treated water on a wholesale basis to each entity for retail distribution.

- In advance of preparing final recommendations for the report, it is suggested that the members of the Steering Committee review the institutional alternatives presented herein and analyze which of the ones illustrated is likely to best fit their particular needs. Following each party's review and analysis, the Steering Committee should meet, discuss each party's perspective and, as a group, determine which institutional arrangement would best benefit Ellis and Southern Dallas Counties' water needs.

- When the Steering Committee has made such a determination, the results will be incorporated into the final report as a recommendation.

TABLE 7-1

PRELIMINARY SCHEDULE
FOR THE REQUIRED TREATMENT PLANT EXPANSIONS
(ALTERNATE NO. 1)

Expansion Year	Expansion Capacity (MGD)		
	Midlothian	Waxahachie	Ennis
Existing Capacity	3	12	6
1990	4	--	5
2000	5	3	3
2010	8	3	3
2020	8	3	4
2030	--	--	--
Total	28	21	21

TABLE 7-2

PROBABLE CAPITAL COSTS FOR ALTERNATE NO. 1
REGIONAL WATER SUPPLY SYSTEM

Item	Probable Costs ($ 1000) 1990	2000	2010	2020	2030
Raw Water Delivery System	2,555	0	2,555	0	0
Water Treatment Plant Expansions	7,250	8,825	11,200	12,000	0
Treated Water Delivery System	17,762	28	17,567	123	144
Interconnecting Pipelines	0	0	3,850	0	0
Total Construction	27,567	8,853	35,172	12,123	144
Engineering and Construction Contingency	5,514	1,770	7,034	2,424	28
Subtotal Project	33,081	10,623	42,206	14,547	172
Implementation Administration	5,624	1,806	7,175	2,473	30
Construction Interest	1,549	497	1,975	681	8
Total Capital Cost	40,254	12,926	51,356	17,701	210

TABLE 7-3

PROBABLE ANNUAL COSTS FOR ALTERNATE NO. 1

REGIONAL WATER SUPPLY SYSTEM

Item	Probable Costs ($1,000)				
	1990	2000	2010	2020	2030
Proposed Facilities Debt Service	4,253	5,618	6,792	7,297	7,297
Existing Facilities Debt Service*	3,521	3,535	3,139	884	0
Pipeline and Pump Station O&M	480	506	865	964	1,084
Water Treatment Plant O&M	2,222	3,030	4,174	5,606	7,006
Raw Water Purchase	871	1,058	2,445	4,704	8,529
TOTAL	11,347	13,747	17,415	19,455	23,916

* Existing facility debt service estimates based on available information from 1987 Budget Reports/Financial Statements for Midlothian and Waxahachie and 1985 Water Facilities Assessment Study for Ennis.

7.3 RECOMMENDED ACTION STEPS

It is recommended that the following steps be taken to implement the recommended plan:

1. The regional entity responsible for implementing the recommended plan should be designated by the study participants and approved by the Texas Water Development Board/Texas Water Commission as required.

2. Agreements between the designated entity and the study participants and/or other local entities desiring to become customers of the regional surface water supply system should be negotiated.

3. The regional entity should initiate discussions and/or negotiations with TCWCID No. 1 to develop guidelines and requirements to purchase the raw water needs of the regional system. (These efforts should be coordinated with TCWCID No. 1 System Economic Studies currently underway and proposed long-range water supply planning study to be conducted by TCWCID No. 1.)

4. The regional entity should develop terminal storage agreements with owners of the proposed terminal storage reservoirs, namely the Army Corps of Engineers and the Trinity River Authority for Bardwell and Joe Pool Lakes and the Ellis County Water Control and Improvement District No. 1 for Waxahachie Lake.

6. The regional entity should further develop the regional system concept as required to prepare a project financing plan including project funding application(s) and to evaluate environmental impact and other aspects required for project financing and permitting.

7. A construction and installation management plan should be developed and should include prioritization of project facilities to develop construction/ installation sequencing.

8. The detailed design required for preparation of construction documents for various segments of the project should be developed. An updated opinion of probable costs should be prepared.

9. Project operation and maintenance procedures should be formalized and adopted to assure that the project adequately meets regional water supply requirements for all customers.

7.4 SCHEDULE

Based on the water supply conditions of the region as discussed earlier in this report, the initial implementation requirements should be started in 1989, if possible. Generalized schedules of significant project activities and milestones for implementation of the regional water supply system are shown on Tables 7-4 through 7-6.

TABLE 7-4

GENERALIZED SCHEDULE
PROPOSED FACILITIES
MIDLOTHIAN SERVICE AREA

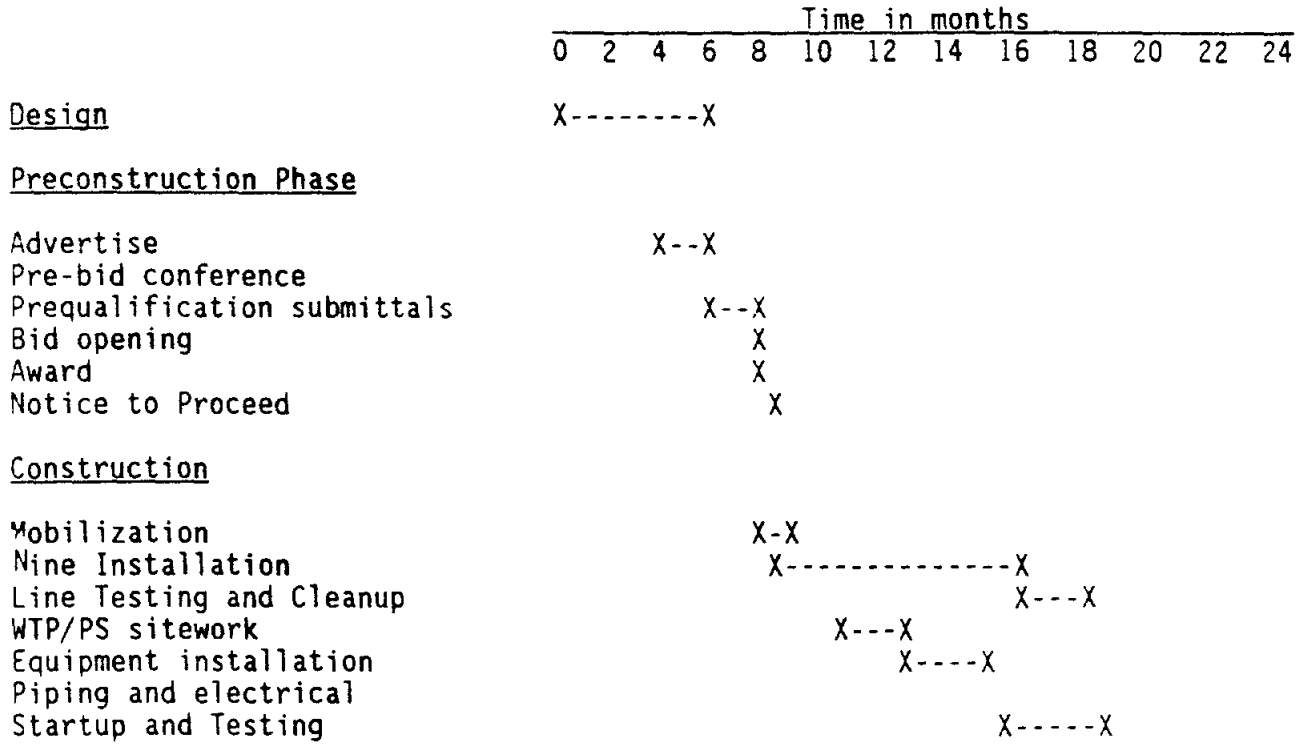
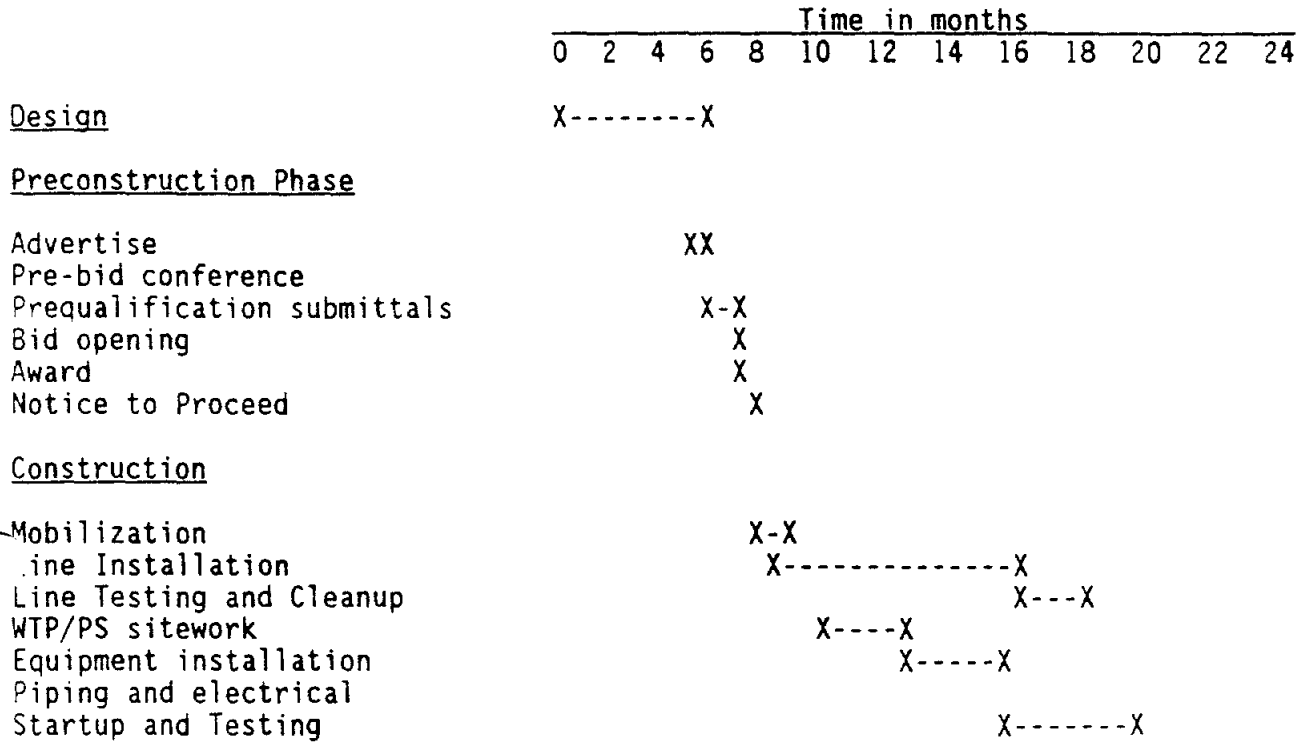


TABLE 7-6

GENERALIZED SCHEDULE
PROPOSED FACILITIES
ENNIS SERVICE AREA



APPENDIX

1. Questionnaire Form
2. Letter from TCWCID No. 1, May 19, 1988
3. Letter from TCWCID No. 1, August 16, 1988
4. Costing Studies
5. TWDB - Rules Relating to Financial Programs

TABLE 7-5

GENERALIZED SCHEDULE
PROPOSED FACILITIES
WAXAHACHIE SERVICE AREA

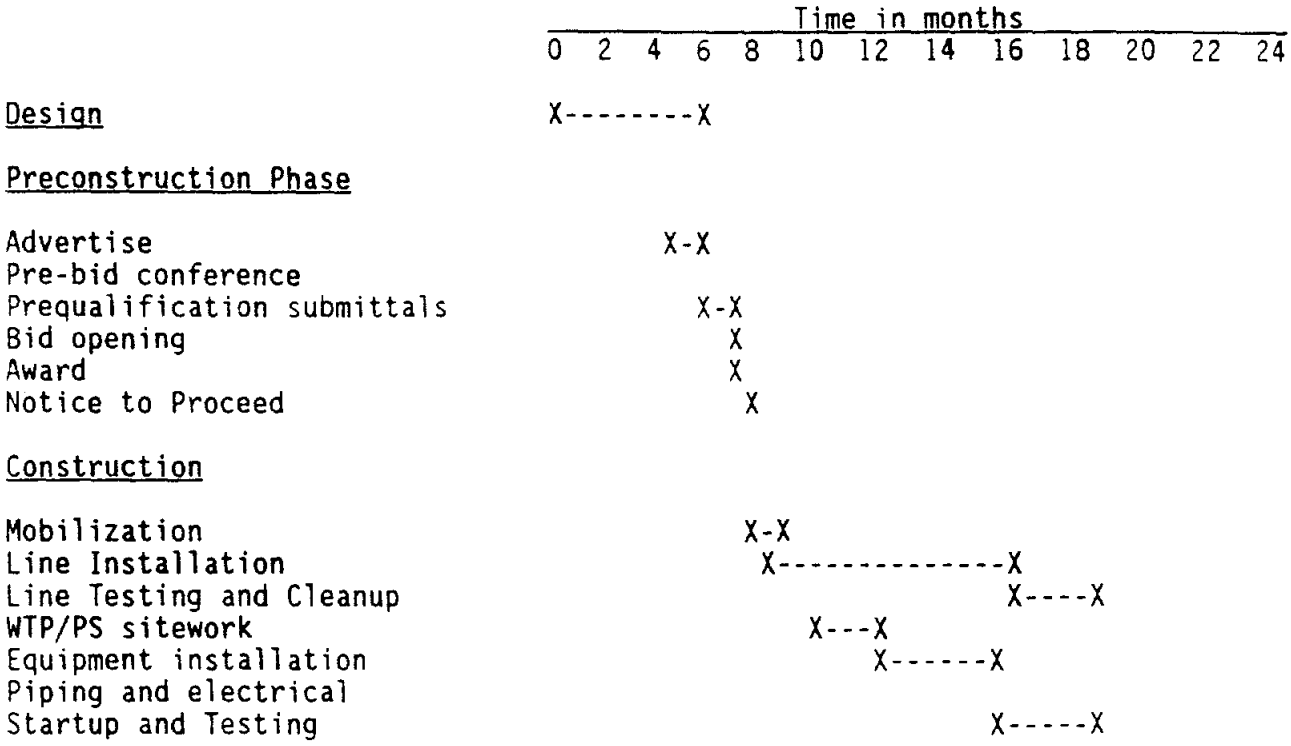
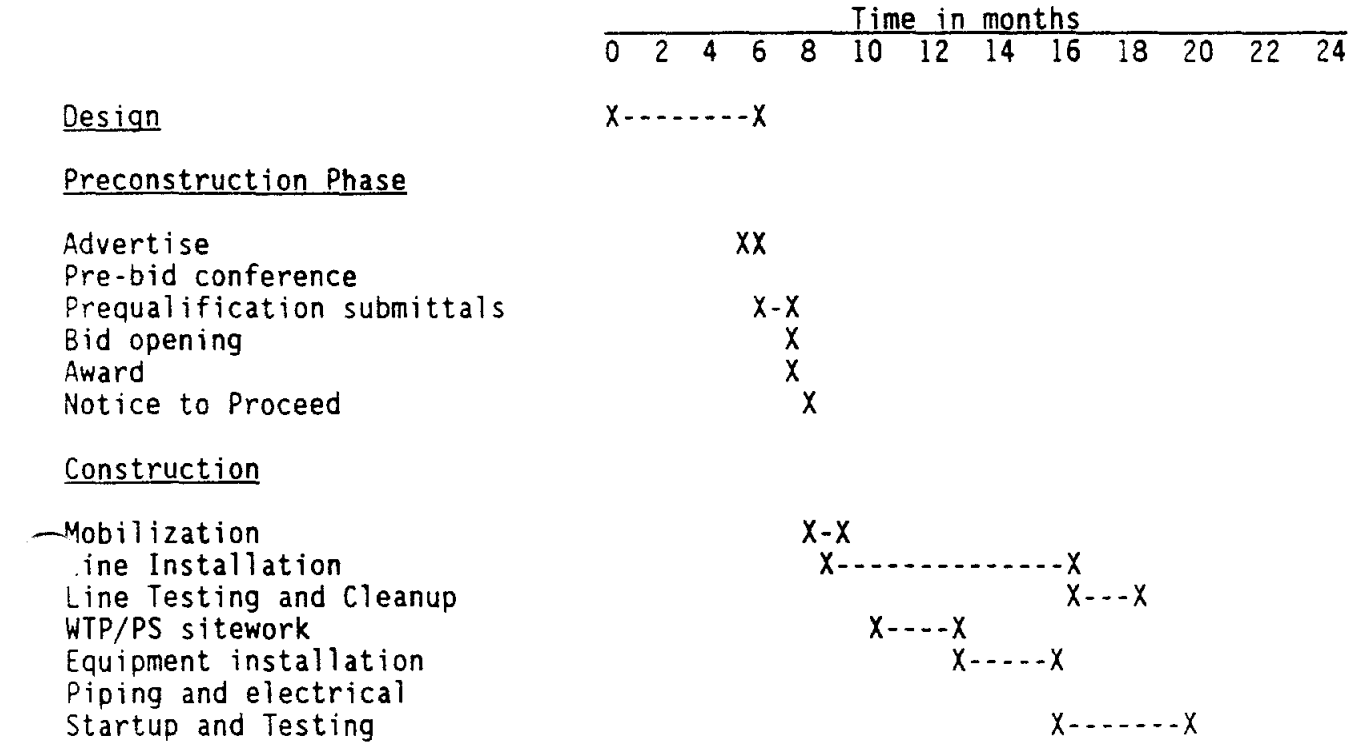


TABLE 7-6

GENERALIZED SCHEDULE
PROPOSED FACILITIES
ENNIS SERVICE AREA



APPENDIX

1. Questionnaire Form
2. Letter from TCWCID No. 1, May 19, 1988
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4. Costing Studies
5. TWDB - Rules Relating to Financial Programs

QUESTIONNAIRE FOR
ELLIS COUNTY WATER STUDY

Agency _____

Date _____

Please return this completed questionnaire to:

Espey, Huston & Associates, Inc.
17811 Waterview Parkway, Suite 400
Dallas, Texas 75252

ATTN: Bill Moriarty

Please contact Bill at 214/669-9600 if you have questions

WATER SUPPLY

1. Provide a map showing limits of your current service area. Also indicate any known or anticipated expansion of your service area and the timing of the expansion.

2. Do you purchase all or part of your water supply on a wholesale basis from another agency? _____. If so, please describe.

3. Provide map showing location of water supply facilities
   - o Raw water intake, pump station and transmission line
   - o Treatment facilities
   - o Wells
   - o Distribution system including pump station
   - o Ground and elevated storage

4. Provide the following information on your current water supply source.

Source

a) Wells No. _____ Capacity _____ MGD

_____ _____ MGD

_____ _____ MGD

_____ _____ MGD

b) Surface Water

1) Raw (Source) _____

*Water Rights (MGD) _____

2) Treated (Source) _____

Supplier _____

Quantity (MGD) _____

*If water rights are held by other agency, provide name of agency, contract quantity and length of contract.

Please list the cities you serve and indicate whether wholesale or retail.

Also indicate what entities other than cities that you serve. Retail or wholesale?

5. Type of Agency. Please describe your agency.

(a) Investor Owned _____

(b) Non-profit corporation _____

(c) Utility district _____

(d) Authority _____

(e) Other (describe)

6. Provide the following population data for your service area:

Historical		Projection	
1960	_____	1990	_____
1970	_____	1995	_____
1980	_____	2000	_____
1986	_____	2005	_____
		2010	_____

Source of Projections _____

7. Provide the following information concerning water consumption:

Historical	1960	1970	1980	1986
Average day demand	_____	_____	_____	_____
Maximum day demand	_____	_____	_____	_____
# of customer connections	_____	_____	_____	_____
Gallons per capita per day	_____	_____	_____	_____

Projected	1990	2000	2010
Average day demand	_____	_____	_____
Maximum day demand	_____	_____	_____
Gallons per capita per day	_____	_____	_____
Source of projections	_____		

Water demand may be in MGD (million gallons per day) or gpm (gallons per minute). Please indicate units used.

8. Provide the following information on existing and proposed expansion of your water supply facilities:

Raw Water Pumping Facilities

Current capacity	_____ MGD	Planned expansion	_____ MGD
Ultimate capacity	_____ MGD	Scheduled in-service (year)	_____
		Estimated Construction Cost	_____

Raw Water Pipeline

Capacity	_____ MGD	Planned new line Capacity	_____ MGD
Size	_____	Size	_____
Length	_____	Length	_____
		Scheduled in-service (year)	_____
		Estimated Construction Cost	_____

Treatment Facilities

Current capacity	_____ MGD	Planned expansion	_____ MGD
Ultimate capacity	_____ MGD	Scheduled in-service (year)	_____
		Estimated Construction Cost	_____

Ground Storage

No. of tanks	_____	Planned additional storage capacity	_____ GAL.
Storage capacity of each tank	_____	Scheduled in-service (year)	_____
Current total storage capacity	_____	Estimated Construction Cost	_____

Elevated Storage

No. of tanks	_____	Planned additional storage capacity	_____ GAL.
Storage capacity of each tank	_____	Scheduled in-service (year)	_____
Current total storage capacity	_____	Estimated Construction Cost	_____

New Wells

a) Capacity_____
Scheduled in-service (year)_____
Estimated construction cost_____

b) Capacity_____
Scheduled in-service (year)_____
Estimated construction cost_____

IMPORTANT

For any of the above facilities for which you indicate a "planned expansion," please list any of the planned facilities that are currently under contract, under construction, or for which you have a firm commitment to construct.

9. Provide current rate schedule for water service. Provide copy of most recent operating budget and/or annual report showing annual revenues, O&M costs.

10. Provide chemical analysis of water source and indicate any treatment that is provided. Note any problems associated with meeting the requirements of the Safe Drinking Water Act and State Drinking Water Standards.

11. Describe significant customer complaints associated with taste, odor, color, pressure.

12. Please identify any Capital Improvement Programs, Engineering Reports or Planning Reports you have that may relate to or be useful in this county-wide planning effort for water supply.

We would appreciate receiving a copy of the above. Please indicate if we need to return the reports to you._____

13. Do you consider your existing water supply adequate to meet your . . .

	YES	NO
. . . Present Needs	_____	_____
. . . Year 1990 Needs	_____	_____
. . . Year 2000 Needs	_____	_____
. . . Year 2010 Needs	_____	_____
. . . Year 2050 Needs	_____	_____

If you do not consider your existing water supply adequate to meet your short or long range needs, is your entity actively planning or negotiating to meet your present or future needs?_____. If yes, please describe.

14. Do you anticipate that your entity may need to obtain an additional water supply through purchases from another entity? Yes_____ No_____

			If yes, approximate year
Treated Water	Yes_____	No_____	_____
Untreated Water	Yes_____	No_____	_____

15. Is your public water supply "Approved" by the State?_____

Please provide the name and telephone number of the person in your organization who can be contacted concerning questions or additional information on the above requested data and information:

Name _____

Telephone No. _____

12,200

TARRANT COUNTY WATER CONTROL AND IMPROVEMENT
DISTRICT NUMBER ONE

800 East North Side Drive
Fort Worth, Texas

P.O. Box 4508
Fort Worth, Texas 76106-0508
Area Code 817-335-2491

James M. Oliver
General Manager

May 19, 1988

Mr. Danny Vance
General Manager
Trinity River Authority
P. O. Box 60
Arlington, Texas 76010

Dear Danny:

The District has been requested to supply 1.58 mgd of water to the Superconducting Super Collider facility if built in Ellis County.

As you are aware, the District currently has a 72-inch pipeline from Cedar Creek in the vicinity of the proposed location. Within 9 months, a second 90-inch pipeline from Richland-Chambers Reservoir should be operational in the same vicinity.

If the Superconducting Super Collider becomes a reality in Ellis County, the District is committed to provide the 1.58 mgd necessary for its operation. The District has had a long-standing working relationship with the Trinity River Authority and we will work with or through the Authority to supply the necessary water to the Super Collider facility.

Very truly yours,

James M. Oliver
General Manager

JMO:sw

TARRANT COUNTY WATER CONTROL AND IMPROVEMENT
DISTRICT NUMBER ONE

800 East North Side Drive
Fort Worth, Texas

P.O. Box 4508
Fort Worth, Texas 76106-0508
Area Code 817-335-2491

James M. Oliver
General Manager

PROJECT/PROPOSAL NO. 330-0200

DATE RECEIVED: AUG 29 1988

August 16, 1988

Mr. Bill R. Smith, Manager
Water Resources Planning
Trinity River Authority of Texas
P.O. Box 240
Arlington, Texas 76010

Re: Trinity River Authority of Texas
Ellis County and Southern Dallas County Water Supply Study

Dear Bill:

As we have discussed, the District has recently completed a service area study which identifies the Ellis County area as being within a logical service area for the District since, in the near future, we will have two major water transmission lines through Ellis County. The main concern the District has with serving this area, however, is the ability of the local customers to provide terminal storage to minimize peaking off the District's pipelines. We feel the terminal storage problem can best be resolved by a single regional entity with combined resources and a regional plan.

The District has had a long and satisfactory relationship with the Trinity River Authority and we feel the TRA has proven its ability to successfully create and operate regional water and wastewater systems. Therefore, the District is very willing to enter into discussions with the TRA concerning supplying raw water to the Ellis County area.

Sincerely,

James M. Oliver

James M. Oliver
General Manager

JMO:js

REGIONAL SUMMARY
ALTERNATE #1

DATE OF PRINTOUT: 03/30/89
TIME OF PRINTOUT: 02:44 PM

Planning Year	1990	2000	2010	2020	2030
Midlothian Service Area Annual Cost	4,602,799	5,431,582	6,279,990	8,621,007	10,497,443
Waxahachie Service Area Annual Cost	3,123,386	3,857,786	5,155,893	4,668,208	6,704,899
Ennis Service Area Annual Cost	3,852,085	4,689,514	5,978,751	6,165,541	6,713,990
Regional Annual Cost	11,578,270	13,978,882	17,414,634	19,454,756	23,916,332
Regional Gross Demand MGD	11.07	15.09	20.79	27.92	34.90
Regional Cost per 1000 Gal	2.87	2.54	2.29	1.91	1.88
Midlothian Service Area Capital Cost	19,178,027	5,850,496	25,304,062	9,456,726	156,602
Waxahachie Service Area Capital Cost	6,725,011	3,548,554	10,866,639	3,510,955	26,283
Ennis Service Area Capital Cost	16,540,787	3,527,382	15,185,310	4,732,744	27,378
	42,443,825	12,926,432	51,356,011	17,700,425	210,263

PRELIMINARY

Alternate #1 - Raw Water Source: TCWCID #1 PIPELINE DIVERSION WITH TERMINAL STORAGE IN JOE POOL LAKE
Water Treatment Plant Service Area - Midlothian
Entities Served - Midlothian; Red Oak; Rockett; Buena-Vista Bethel; Maypearl; SSC

DATE OF PRINTOUT: 03/30/89
TIME OF PRINTOUT: 08:58 AM

Planning Year			1990	2000	2010	2020	2030
New Raw Water Demand - MGD							
Average			1.90	2.66	3.96	6.88	9.71
Peak	2.00		3.80	4.12	7.92	13.76	19.42
Gross Raw Water Demand - MGD							
Average			2.87	3.6	6.23	10.09	13.99
Peak	2.00		5.74	7.20	12.46	20.18	27.98

CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir												
Land												
Sub-total Raw Water Development Costs												
Raw Water Delivery												
Intake Structure	@ $500,000 ea.		1	500,000	0	0	0	0	0	0	0	0
Land	@ $5,000/acre			0	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp			0		0		0		0		0
Land	@ $5,000/acre			0	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50	19,000	950,000	0	0	19,000	950,000	0	0	0	0
	20	42		0	0	0	0	0	0	0	0	0
	18	38		0	0	0	0	0	0	0	0	0
	16	34		0	0	0	0	0	0	0	0	0
	12	25		0	0	0	0	0	0	0	0	0
4-Way	@ $25,000/mile		4	89,962	0	0	3	75,000	0	0	0	0
Sub-total Raw Water Delivery Costs				1,539,962		0		1,025,000		0		0
Treatment and Conveyance												
Treatment Plant												
Phase I	@ $800,000/MGD		4.00	3,200,000	0	0	0	0	0	0	0	0
Phase II	@ $800,000/MGD		0	0	5.00	4,000,000	0	0	0.00	0	0	0
Phase III	@ $800,000/MGD		0	0	0	0	8.00	6,400,000	0	0	0	0
Phase IV	@ $800,000/MGD		0	0	0	0	0	0	8.00	6,400,000	0	0
Land	@ $5,000/acre		5	25,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		118	88,500	9	6,750	118	88,500	102	76,500	143	107,250
Land	@ $5,000/acre		20	100,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50		0	0	0	0	0	0	0	0	0
	20	42		0	0	0	0	0	0	0	0	0

$25,000/mi x 1mi/640ac $39/ac. JUNK
Reasonable Est?

	18	38	90,900	3,454,200	0	0	90,900	3,454,200	0	0	0	0
	16	34	89,800	3,053,200	0	0	89,800	3,053,200	0	0	0	0
	12	25	7,400	185,000	0	0	7,400	185,000	0	0	0	0
	8	17	27500	467,500	0	0	27500	467,500	0	0	0	0
Right-of-Way	@ $25,000/mile		41	1,020,833	0	0	41	1,020,833	0	0	0	0
Sub-total Treatment & Conveyance Costs				11,594,233		4,006,750		14,669,233		6,476,500		107,250
Interconnecting Lines	12"	$25	0	0	0	0	55,000	1,375,000	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	10	260,417	0	0	0	0
Sub-total Interconnecting Lines				0		0		1,635,417		0		0
TOTAL CONSTRUCTION COST				13,134,195		4,006,750		17,329,650		6,476,500		107,250
Engineering and Construction Contingency		20%		2,626,839		801,350		3,465,930		1,295,300		21,450
Implementation Administration		17%		2,679,376		817,377		3,535,249		1,321,206		21,879
Financial - Interest During Const After 1st yr		4%		737,616		225,019		973,233		363,720		6,023
TOTAL CAPITAL COST				19,178,027		5,850,496		25,304,062		9,456,726		156,602
TOTAL RESERVOIR COST				0		0						

ANNUAL COSTS

Proposed System Debt Service 8.5%; 20 years	CRF= .10567	2,026,542	2,644,764	3,292,102	3,673,172	3,673,172
Reservoir O & M	0.2% X Reservoir cap cost x 1.2	0	0	0	0	0
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2	0	0	0	0	0
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr	0	0	0	0	0
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2	11,400	11,400	22,800	22,800	22,800
Water Treatment Plant O & M	$0.55/1000 gal	576,153	722,700	1,250,673	2,025,568	2,808,493
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2	3,186	3,429	6,615	9,369	13,230
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08+KWHR	61,690	66,395	128,085	181,410	256,170
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2	85,919	85,919	171,838	171,838	171,838
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2	0	0	16,500	16,500	16,500
Reservoir Storage Space Use Fee		51,000	52,400	54,200	56,600	59,700
Existing Facility Debt Service		1,265,581	1,280,431	0	0	0
SERVICE AREA ANNUAL COST SUBTOTAL		4,081,470	4,867,438	4,942,812	6,157,257	7,021,903
RAW WATER PURCHASE, UNIT COST		0.69	0.69	0.85	0.90	0.90
RAW WATER PURCHASE, ANNUAL COST	(Avg. New Water + Evap) X Unit $	521,329	564,144	1,337,178	2,463,750	3,475,530
TOTAL ANNUAL COST FOR MIDLOTHIAN SERVICE AREA		4,602,799	5,431,582	6,279,990	8,621,007	10,497,433
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)		4.39	4.13	2.76	2.34	2.96

Alternate 01 - Raw Water Source: TCWCID #1 PIPELINE DIVERSION WITH TERMINAL STORAGE IN LAKE WAXAHACHIE
Water Treatment Plant Service Area - Waxahachie
Entities Served - Waxahachie; Italy; Milford

DATE OF PRINTOUT: 03/30/89
TIME OF PRINTOUT: 09:03 AM

Planning Year			1990	2000	2010	2020	2030
New Raw Water Demand - MGD							
Average			0.32	0.48	0.69	2.02	3.34
Peak	2.00		0.64	0.96	1.38	4.04	6.68
Gross Raw Water Demand - MGD							
Average			4.46	6.01	7.52	9.07	10.39
Peak	2.00		8.92	12.02	15.04	18.14	20.78

CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir												
Land												
Sub-total Raw Water Development Costs												
Raw Water Delivery												
Intake Structure	@ $500,000 ea.		1	500,000	0	0	0	0	0	0	0	0
Land	@ $5,000/acre			0	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp			0		0		0		0		0
Land	@ $5,000/acre			0	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50		0	0	0	0	0	0	0	0	0
	20	42		0	0	0	0	0	0	0	0	0
	18	38		0	0	0	0	0	0	0	0	0
	16	34		0	0	0	0	0	0	0	0	0
	12	25	32,700	817,500	0	0	32,700	817,500	0	0	0	0
Right-of-Way	@ $25,000/mile		6	154,830	0	0	6	154,830	0	0	0	0
Sub-total Raw Water Delivery Costs				1,472,330		0		972,330		0		0
Treatment and Conveyance												
Treatment Plant												
PHASE I	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
PHASE II	@ $800,000/MGD		0.00	0	3.00	2,400,000	0.00	0	0.00	0	0.00	0
PHASE III	@ $800,000/MGD		0.00	0	0.00	0	3.00	2,400,000	0.00	0	0.00	0
PHASE IV	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	3.00	2,400,000	0.00	0
Land	@ $5,000/acre		0	0	5	25,000	0	0	0	0	0	0
Pump Station	@ $750/hp		14	10,500	7	5,250	9	6,750	6	4,500	24	18,000
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50		0	0	0	0	0	0	0	0	0
	20	42		0	0	0	0	0	0	0	0	0

	18	38		0	0	0	0	0	0	0	0	0
	16	34		0	0	0	0	0	0	0	0	0
	12	25	77,100	1,927,500	0	0	77,100	1,927,500	0	0	0	0
	8	17	35,900	610,300	0	0	35,900	610,300	0	0	0	0
Right-of-Way	@ $25,000/mile		21	535,038	0	0	21	535,038	0	0	0	0
Sub-total Treatment & Conveyance Costs				3,133,338		2,430,250		5,479,588		2,404,500		18,000
Interconnecting Lines	12"	$25	0	0	0	0	33,300	832,500	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	6	157,670	0	0	0	0
Sub-total Interconnecting Lines				0		0		990,170		0		0
TOTAL CONSTRUCTION COST				4,605,667		2,430,250		7,442,088		2,404,500		18,000
Engineering and Construction Contingency		20%		921,133		486,050		1,488,418		480,900		3,600
Implementation Administration		17%		939,556		495,771		1,518,186		490,518		3,672
Financial - Interest During Const After 1st yr		4%		258,654		136,483		417,948		135,037		1,011
TOTAL CAPITAL COST				6,725,011		3,548,554		10,866,639		3,510,955		26,283
TOTAL RESERVOIR COST				0		0						

ANNUAL COSTS

Proposed System Debt Service 8.5%; 20 years	CRF= .10567		710,632		1,085,608		1,523,253	1,519,280	1,519,280
Reservoir O & M	0.2% X Reservoir cap cost x 1.2		0		0		0	0	0
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2		0		0		0	0	0
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr		0		0		0	0	0
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2		9,810		9,810		19,620	19,620	19,620
Water Treatment Plant O & M	$0.55/1000 gal		895,345		1,206,508		1,509,640	1,820,803	2,085,793
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2		378		567		810	972	1,620
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08*KWHR		7,319		10,979		15,684	18,821	31,368
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2		30,454		30,454		60,907	60,907	60,907
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2		0		0		9,990	9,990	9,990
Reservoir Storage Space Use Fee			93,600		95,200		97,400	100,200	103,800
Existing Facility Debt Service			1,287,700		1,287,700		1,685,900	398,200	0
SERVICE AREA ANNUAL COST SUBTOTAL			3,035,238		3,726,824		4,923,205	3,948,793	3,832,378
RAW WATER PURCHASE, UNIT COST			0.69		0.69		0.85	0.90	0.90
RAW WATER PURCHASE, ANNUAL COST	Avg. New Water + Evaporation		88,148		130,962		232,688	719,415	2,872,521
TOTAL ANNUAL COST FOR WAIAHACHIE SERVICE AREA			3,123,386		3,857,786		5,155,893	4,668,208	6,704,899
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)			1.92		1.76		1.88	1.41	1.77

Alternate #1 - Raw Water Source: TCWCID #1 PIPELINE DIVERSION WITH TERMINAL STORAGE IN BARDWELL
Water Treatment Plant Service Area - Ennis
Entities Served - Ennis with East Garrett; Boyce; Palmer; Bristol; Ferris; Milmer

DATE OF PRINTOUT: 05/30/89
TIME OF PRINTOUT: 08:54 AM

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			0.91		1.26		2.33		4.05		5.81	
Peak 2.00			1.82		2.52		4.66		8.10		11.62	
Gross Raw Water Demand - MGD												
Average			3.74		5.48		7.04		8.76		10.52	
Peak 2.00			7.48		10.96		14.08		17.52		21.04	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir												
Land												
Sub-total Raw Water Development Costs												
Raw Water Delivery												
Intake Structure	@ $500,000 ea.		1	500,000	0	0	0	0	0	0	0	0
Land	@ $5,000/acre			0	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp			0		0		0		0		0
Land	@ $5,000/acre			0	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50		0	0	0	0	0	0	0	0	0
	20	42		0	0	0	0	0	0	0	0	0
	18	38	12,700	482,600	0	0	12,700	482,600	0	0	0	0
	16	34		0	0	0	0	0	0	0	0	0
	12	25		0	0	0	0	0	0	0	0	0
Right-of-Way	@ $25,000/mile		2	60,133	0	0	3	75,000	0	0	0	0
Sub-total Raw Water Delivery Costs				1,042,733		0		557,600		0		0
Treatment and Conveyance												
Treatment Plant												
PHASE I	@ $800,000/MGD		5.00	4,000,000	0.00	0	0.00	0	0.00	0	0.00	0
PHASE II	@ $800,000/MGD		0.00	0	3.00	2,400,000	0.00	0	0.00	0	0.00	0
PHASE III	@ $800,000/MGD		0.00	0	0.00	0	3.00	2,400,000	0.00	0	0.00	0
PHASE IV	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	4.00	3,200,000	0.00	0
Land	@ $5,000/acre		5	25,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		55	41,250	21	15,750	64	48,000	55	41,250	25	18,750
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50		0	0	0	0	0	0	0	0	0
	20	42		0	0	0	0	0	0	0	0	0

	18	38	41,400	1,573,200	0	0	41,400	1,573,200	0	0	0	0
	16	34	65,800	2,237,200	0	0	65,800	2,237,200	0	0	0	0
	12	25	17,300	432,500	0	0	17,300	432,500	0	0	0	0
	8	17	61,500	1,045,500	0	0	61,500	1,045,500	0	0	0	0
Right-of-Way	@ $25,000/mile		35	880,682	0	0	35	880,682	0	0	0	0
Sub-total Treatment & Conveyance Costs				10,285,332		2,415,750		8,617,082		3,241,250		18,750
Interconnecting Lines	12"	$25	0	0	0	0	41,200	1,030,000	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	8	195,076	0	0	0	0
Sub-total Interconnecting Lines				0		0		1,225,076		0		0
TOTAL CONSTRUCTION COST				11,328,064		2,415,750		10,399,758		3,241,250		18,750
Engineering and Construction Contingency		20%		2,265,613		483,150		2,079,952		648,250		3,750
Implementation Administration		17%		2,310,925		492,813		2,121,551		661,215		3,825
Financial - Interest During Const After 1st yr		4%		636,184		135,669		584,050		182,029		1,053
TOTAL CAPITAL COST				16,540,787		3,527,382		15,185,310		4,732,744		27,378
TOTAL RESERVOIR COST				0		0						
ANNUAL COSTS												
Proposed System Debt Service 8.5%; 20 years	CRF= .10567			1,747,865		2,120,603		1,977,370		2,104,741		2,104,741
Reservoir O & M	0.2% X Reservoir cap cost x 1.2			0		0		0		0		0
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2			0		0		0		0		0
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr			0		0		0		0		0
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2			5,791		5,791		11,582		11,582		11,582
Water Treatment Plant O & M	$0.55/1000 gal			750,805		1,100,110		1,413,280		1,758,570		2,111,890
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2			1,485		2,052		3,780		5,265		5,940
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08*KWHR			28,754		39,733		73,192		101,945		115,015
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2			63,461		63,461		126,922		126,922		126,922
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2			0		0		12,360		12,360		12,360
Reservoir Storage Space Use Fee				25,000		28,100		32,200		37,400		44,300
Existing Facility Debt Service				967,000		967,000		1,452,800		485,800		0
SERVICE AREA ANNUAL COST				3,590,161		4,326,850		5,103,486		4,644,585		4,532,750
RAW WATER PURCHASE, UNIT COST				0.69		0.69		0.85		0.90		0.90
RAW WATER PURCHASE, ANNUAL COST	Avg. New Water + Evaporation			261,924		362,664		875,265		1,520,955		2,181,240
TOTAL ANNUAL COST FOR ENNIS SERVICE AREA				3,852,085		4,689,514		5,978,751		6,165,541		6,713,990
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)				2.82		2.34		2.33		1.93		1.75

REGIONAL SUMMARY
ALTERNATE #2

DATE OF PRINTOUT: 03/13/89
TIME OF PRINTOUT: 03:11 PM

Planning Year	1990	2000	2010	2020	2030
Midlothian Service Area Annual Cost	3,330,168	6,447,931	7,199,282	9,050,742	10,745,524
Waxahachie Service Area Annual Cost	4,823,748	7,605,272	8,588,444	8,110,974	9,143,613
Ennis Service Area Annual Cost	3,729,620	6,442,921	7,444,223	7,197,859	7,534,561
Regional Annual Cost	11,883,536	20,496,124	23,231,949	24,359,575	27,423,698
Regional Gross Demand MGD	11.07	15.09	20.79	27.92	34.90
Regional Cost per 1000 Gal	2.94	3.72	3.06	2.39	2.15
Midlothian Service Area Capital Cost	15,437,408	29,875,651	24,642,644	14,663,065	1,172,874
Waxahachie Service Area Capital Cost	13,815,396	24,321,397	13,572,835	7,734,961	1,758,763
Ennis Service Area Capital Cost	15,759,893	23,599,968	14,279,422	8,791,087	422,716
	45,012,697	77,797,016	52,494,901	31,189,113	3,354,353

Alternate #2 - Raw Water Source: ITALY RESERVOIR
Water Treatment Plant Service Area: Midlothian
Entities Served - Midlothian; Red Oak; Rockett

DATE OF PRINTOUT: 03/13/89
TIME OF PRINTOUT: 02:42 PM

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			0.00		0.00		1.68		4.34		6.91	
Peak	2.00		0.00		0.00		3.36		8.68		13.82	
Gross Raw Water Demand - MGD												
Average			0.97		1.54		3.95		7.55		11.19	
Peak	2.00		1.94		3.08		7.90		15.10		22.38	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir				0		4,973,700		0		0		0
Land				0		3,793,600		0		0		0
Contingency - Environmental Conflict				0		2,251,888						
Sub-total Raw Water Development Costs				0		11,019,188		0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.				1	500,000	0	0	0	0	0	0
Land	@ $5,000/acre				5	25,000	0	0	0	0	0	0
Pump Station	@ $750/hp				220	165,000	240	180,000	727	545,250	703	527,250
Land	@ $5,000/acre				10	50,000	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0		0		0		0		0
	42	88		0		0		0		0		0
	36	76		0		0	0	0	0	0	0	0
	30	63		0		0		0		0		0
	27	57		0		0		0		0		0
	24	50		0	84,500	4,225,000		0		0		0
	20	42		0		0		0		0		0
	18	38	19,000	722,000		0	0	0	84,500	3,211,000		0
	16	34		0		0		0		0		0
	12	25		0		0		0		0		0
Right-of-Way	@ $25,000/mile		4	89,962	16	400,095	0	0	16	400,095	0	0
Sub-total Raw Water Delivery Costs				811,962		5,365,095		180,000		4,156,345		527,250
Treatment and Conveyance												
Treatment Plant												
PHASE I	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
PHASE II	@ $800,000/MGD		0.00	0	5.00	4,000,000	0.00	0	0.00	0	0.00	0
PHASE III	@ $800,000/MGD		0.00	0	0.00	0	7.00	5,600,000	0.00	0	0.00	0
PHASE IV	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	7.00	5,600,000	0.00	0
Land	@ $5,000/acre		0	0	10	50,000	0	0	0	0	0	0
Pump Station	@ $750/hp		59	44,250	35	26,250	147	110,250	381	285,750	368	276,000
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101						0		0		0
	42	88						0		0		0
	36	76					0	0	0	0	0	0
	30	63					0	0	0	0	0	0
	27	57	21,100	1,139,400			21,100	1,139,400	0	0	0	0
	24	50	67,000	3,216,000			67,000	3,216,000	0	0	0	0

	20	42	67,000	2,479,000			67,000	2,479,000		0		0
	18	38	43,200	1,512,000			43,200	1,512,000		0		0
	16	34							0	0	0	0
	12	25	14,800	310,800			14,800	310,800		0		0
Right-of-Way	@ $25,000/mile	40		1,008,996	0	0	40	1,008,996	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs				9,760,446		4,076,250		15,376,446		5,885,750		276,000
Interconnecting Lines	12"	$25					44,400	1,110,000	0	0	0	0
Right-of-Way	@ $25,000/mile						8	210,227	0	0	0	0
Sub-total Interconnecting Lines								1,320,227		0		0
TOTAL CONSTRUCTION COST				10,572,408		20,460,333		16,876,673		10,042,095		803,250
Engineering and Construction Contingency		20%		2,114,482		4,092,107		3,375,335		2,008,419		160,650
Implementation Administration		17%		2,156,771		4,173,949		3,442,841		2,048,587		163,863
Financial - Interest During Const After 1st yr		4%		593,746		1,149,064		947,794		563,964		45,111
TOTAL CAPITAL COST				15,437,408		29,875,651		24,642,644		14,663,065		1,172,874
TOTAL RESERVOIR COST				0		16,089,778						

ANNUAL COSTS

Proposed System Debt Service 8.5%; 20 years	CRF= .10567			1,631,271		3,088,024		4,060,741		4,153,434		4,153,434
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08861			0		1,422,497		1,422,497		1,422,497		1,422,497
Reservoir O & M	0.2% X Reservoir cap cost x 1.2			0		11,937		11,937		11,937		11,937
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2			0		5,940		12,420		32,049		51,030
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr			0		115,015		240,487		620,560		988,086
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2			8,664		59,364		59,364		97,896		97,896
Water Treatment Plant O & M	$0.55/1000 gal			194,728		309,155		792,963		1,515,663		2,246,393
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2			1,593		2,538		6,507		16,794		26,730
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08*KWHR			30,845		49,143		125,994		325,180		517,569
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2			103,886		103,886		207,773		207,773		207,773
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2			0		0		13,320		13,320		13,320
Reservoir Storage Space Use Fee				93,600		0		0		0		0
Existing Facility Debt Service				1,265,581		1,280,431		0		0		0
SERVICE AREA ANNUAL COST				3,330,168		6,447,931		6,954,002		8,417,102		9,736,664
RAW WATER PURCHASE, UNIT COST				0.69		0.40		0.40		0.40		0.40
RAW WATER PURCHASE, ANNUAL COST				0		0		245,280		633,640		1,008,860
TOTAL ANNUAL COST FOR MIDLOTHIAN SERVICE AREA				3,330,168		6,447,931		7,199,282		9,050,742		10,745,524
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)				9.41		11.47		4.99		3.28		2.63

Alternate 02 - Raw Water Source: ITALY RESERVOIR
Water Treatment Plant Service Area: Waxahachie
Entities Served - Waxahachie; Italy; Milford; SSC; Maypearl; Buena Vista/Bethel

DATE OF PRINTOUT: 03/13/89
TIME OF PRINTOUT: 02:56 PM

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			2.22		2.54		2.97		4.56		6.14	
Peak 2.00			4.44		5.08		5.94		9.12		12.28	
Gross Raw Water Demand - MGD												
Average			6.36		8.07		9.8		11.61		13.19	
Peak 2.00			12.72		16.14		19.60		23.22		26.38	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir				0		4,420,900		0		0		0
Land				0		3,371,600		0		0		0
Contingency - Environmental Conflicts				0		2,112,628						
Sub-total Raw Water Development Costs				0		9,905,128		0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.		0	0	1	500,000	0	0	0	0	0	0
Land	@ $5,000/acre		0	0	5	25,000	0	0	0	0	0	0
Pump Station	@ $750/hp		0	0	620	465,000	225	168,750	655	491,250	1,500	1,125,000
Land	@ $5,000/acre		0	0	10	50,000	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63	0	0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50	0	0	60,200	3,010,000	0	0	0	0	0	0
	20	42	0	0	0	0	0	0	0	0	0	0
	18	38	32,700	1,242,600	0	0	0	0	0	0	0	0
	16	34		0	0	0	0	0	60,200	2,046,800	0	0
	12	25		0	0	0	0	0	0	0	0	0
Right-of-Way	@ $25,000/mile		6	154,830	11	285,038	0	0	11	285,038	0	0
Sub-total Raw Water Delivery Costs				1,397,430		4,335,038		168,750		2,823,088		1,125,000
Treatment and Conveyance												
Treatment Plant												
PHASE I	@ $800,000/MGD		4	3,200,000	0	0	0	0	0	0	0	0
PHASE II	@ $800,000/MGD		0	0	3	2,400,000	0	0	0	0	0	0
PHASE III	@ $800,000/MGD		0	0	0	0	4	3,200,000	0	0	0	0
PHASE IV	@ $800,000/MGD		0	0	0	0	0	0	3	2,400,000	0	0
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		153	114,750	22	16,500	30	22,500	99	74,250	106	79,500
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57	4,200	239,400	0	0	4,200	239,400	0	0	0	0
	24	50	20,600	1,030,000	0	0	20,600	1,030,000	0	0	0	0

	20	42	9,500	399,000	0	0	9,500	399,000	0	0	0	0
	18	38		0	0	0	0	0	0	0	0	0
	16	34		0	0	0	0	0	0	0	0	0
	12	25	57,000	1,425,000	0	0	57,000	1,425,000	0	0	0	0
	8	17	51,700	878,900	0	0	51,700	878,900	0	0	0	0
Right-of-Way	@ $25,000/mile		27	677,083	0	0	27	677,083	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs				8,064,133		2,416,500		7,871,883		2,474,250		79,500
Interconnecting Lines	12"	$25	0	0	0	0	42,200	1,055,000	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	8	199,811	0	0	0	0
Sub-total Interconnecting Lines				0		0		1,254,811		0		0
TOTAL CONSTRUCTION COST				9,461,563		16,656,666		9,295,444		5,297,338		1,204,500
Engineering and Construction Contingency		20%		1,892,313		3,331,333		1,859,089		1,059,468		240,900
Implementation Administration		17%		1,930,159		3,397,960		1,896,271		1,080,657		245,718
Financial - Interest During Const After 1st yr		4%		531,361		935,438		522,032		297,498		67,645
TOTAL CAPITAL COST				13,815,396		24,321,397		13,572,835		7,734,961		1,758,763
TOTAL RESERVOIR COST				0		14,463,072						

ANNUAL COSTS

Proposed System Debt Service 8.5%; 20 years	CRF= .10567	1,459,873	2,501,602	2,475,971	2,251,595	2,251,595
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08841	0	1,278,680	1,278,680	1,278,680	1,278,680
Reservoir O & M	0.2% X Reservoir cap cost x 1.2	0	10,610	10,610	10,610	10,610
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2	0	16,740	22,815	40,500	81,000
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr	0	324,134	441,763	784,195	1,568,390
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2	14,911	51,031	51,031	75,593	75,593
Water Treatment Plant O & M	$0.55/1000 gal	1,276,770	1,620,053	1,967,350	2,330,708	2,647,893
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2	4,131	4,725	5,535	8,208	11,070
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08#KWHR	79,988	91,489	107,173	158,930	214,347
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2	47,668	47,668	95,335	95,335	95,335
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2	0	0	12,660	12,660	12,660
Reservoir Storage Space Use Fee		93,600	0	0	0	0
Existing Facility Debt Service		1,287,700	1,287,700	1,685,900	398,200	0
SERVICE AREA ANNUAL COST		4,264,641	7,234,432	8,154,824	7,445,214	8,247,173
RAW WATER PURCHASE, UNIT COST		0.69	0.40	0.40	0.40	0.40
RAW WATER PURCHASE, ANNUAL COST		559,107	370,840	433,620	665,760	896,440
TOTAL ANNUAL COST FOR WAXAHACHIE SERVICE AREA		4,823,748	7,605,272	8,588,444	8,110,974	9,143,613
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)		2.00	2.50	2.40	1.91	1.90

Alternate 82 - Raw Water Source: ITALY RESERVOIR
Water Treatment Plant Service Area: Ennis
Entities Served - Ennis with East Garrett; Boyce; Palmer; Bristol, Ferris; Milmer

DATE OF PRINTOUT: 03/13/89
TIME OF PRINTOUT: 03:01 PM

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			0.91		1.26		2.33		4.05		5.01	
Peak	2.00		1.82		2.52		4.66		8.10		11.62	
Gross Raw Water Demand - MGD												
Average			3.74		5.48		7.04		8.76		10.52	
Peak	2.00		7.48		10.96		14.08		17.52		21.04	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir				0		4,183,300		0		0		0
Land				0		3,190,720		0		0		0
Contingency - Environmental Conflicts				0		2,052,938						
Sub-total Raw Water Development Costs				0		9,426,958		0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.		0	0	1	500,000	0	0	0	0	0	0
Land	@ $5,000/acre		0	0	5	25,000	0	0	0	0	0	0
Pump Station	@ $750/hp		0	0	217	162,750	184	138,000	296	222,000	303	227,250
Land	@ $5,000/acre		0	0	10	50,000	0	0	0	0	0	0
Pipeline	Size	$/LF	0									
	48	101	0	0	0	0	0	0	0	0	0	0
	42	88	0	0	0	0	0	0	0	0	0	0
	36	76	0	0	0	0	0	0	0	0	0	0
	30	63	0	0	0	0	0	0	0	0	0	0
	27	57	0	0	0	0	0	0	0	0	0	0
	24	50	0	0	65,500	3,275,000	0	0	0	0	0	0
	20	42	0	0	0	0	0	0	0	0	0	0
	18	38	0	0	0	0	0	0	0	0	0	0
	16	34	12,700	431,800	0	0	0	0	65,500	2,227,000	0	0
	12	25	0	0	0	0	0	0	0	0	0	0
Right-of-Way	@ $25,000/mile		2	60,133	12	310,133	0	0	12	310,133	0	0
Sub-total Raw Water Delivery Costs				491,933		4,322,883		138,000		2,759,133		227,250
Treatment and Conveyance												
Treatment Plant												
PHASE I	@ $800,000/MGD		5.00	4,000,000	0.00	0	0.00	0	0.00	0	0.00	0
PHASE II	@ $800,000/MGD		0.00	0	3.00	2,400,000	0.00	0	0.00	0	0.00	0
PHASE III	@ $800,000/MGD		0.00	0	0.00	0	3.00	2,400,000	0.00	0	0.00	0
PHASE IV	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	4.00	3,200,000	0.00	0
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		43	32,250	17	12,750	50	37,500	82	61,500	83	62,250
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50	0	0	0	0	0	0	0	0	0	0

	20	42		0	0	0	0	0	0	0	0	0
	18	38	41,400	1,573,200	0	0	41,400	1,573,200	0	0	0	0
	16	34	65,800	2,237,200	0	0	65,800	2,237,200	0	0	0	0
	12	25	17,300	432,500	0	0	17,300	432,500	0	0	0	0
	8	17	61,500	1,045,500	0	0	61,500	1,045,500	0	0	0	0
Right-of-Way	@ $25,000/mile		35	880,682	0	0	35	880,682	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs				10,301,332		2,412,750		8,606,582		3,261,500		62,250
Interconnecting Lines	12"	$25	0	0	0	0	34,800	870,000	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	7	164,773	0	0	0	0
Sub-total Interconnecting Lines				0		0		1,034,773		0		0
TOTAL CONSTRUCTION COST				10,793,264		16,162,590		9,779,355		6,020,633		289,500
Engineering and Construction Contingency		20%		2,158,653		3,232,518		1,955,871		1,204,127		57,900
Implementation Administration		17%		2,201,826		3,297,168		1,994,988		1,228,209		59,058
Financial - Interest During Const After 1st yr		4%		606,150		907,691		549,209		338,119		16,258
TOTAL CAPITAL COST				15,759,893		23,599,968		14,279,422		8,791,087		422,716
TOTAL RESERVOIR COST				0		13,764,866						

ANNUAL COSTS

Proposed System Debt Service 8.5%; 20 years	CRF= .10567	1,665,348	2,704,623	2,548,182	2,437,861	2,437,861
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08841	0	1,216,952	1,216,952	1,216,952	1,216,952
Reservoir O & M	0.2% X Reservoir cap cost x 1.2	0	10,040	10,040	10,040	10,040
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2	0	5,859	10,827	18,819	27,000
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr	0	113,447	209,642	364,389	522,797
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2	5,182	44,482	44,482	71,206	71,206
Water Treatment Plant O & M	$0.55/1000 gal	750,805	1,100,110	1,413,280	1,758,570	2,111,890
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2	1,161	1,620	2,970	5,184	7,425
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08*KWHR	22,480	31,368	57,508	100,377	143,769
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2	63,461	63,461	126,922	126,922	126,922
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2	0	0	10,440	10,440	10,440
Reservoir Storage Space Use Fee		25,000	0	0	0	0
Existing Facility Debt Service		967,000	967,000	1,452,800	485,800	0
SERVICE AREA ANNUAL COST		3,500,437	6,258,961	7,104,043	6,606,559	6,686,301
RAW WATER PURCHASE, UNIT COST		0.69	0.40	0.40	0.40	0.40
RAW WATER PURCHASE, ANNUAL COST		229,184	183,960	340,180	591,300	848,260
TOTAL ANNUAL COST FOR HAMMACHIE SERVICE AREA		3,729,620	6,442,921	7,444,223	7,197,859	7,534,561
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)		2.73	3.22	2.90	2.25	1.96

REGIONAL SUMMARY
ALTERNATE #3

DATE OF PRINTOUT: 03/23/89
TIME OF PRINTOUT: 09:23 AM

Planning Year	1990	2000	2010	2020	2030
Midlothian Service Area Annual Cost	3,409,994	7,857,074	8,510,945	11,482,943	13,367,550
Waxahachie Service Area Annual Cost	4,875,948	7,654,402	8,558,377	7,894,651	8,329,110
Ennis Service Area Annual Cost	3,710,613	6,387,804	7,376,128	7,086,765	7,381,682
Regional Annual Cost	11,996,555	21,899,280	24,445,450	26,464,359	29,078,342
Regional Gross Demand MGD	11.07	15.09	20.79	27.92	34.90
Regional Cost per 1000 Gal	2.97	3.98	3.22	2.60	2.28
Midlothian Service Area Capital Cost	16,711,234	43,943,675	26,979,776	18,486,665	1,445,558
Waxahachie Service Area Capital Cost	13,815,396	24,401,122	13,442,516	7,442,564	567,272
Ennis Service Area Capital Cost	15,592,997	23,538,933	14,229,047	8,710,048	339,487
	46,119,627	91,883,730	54,651,339	34,639,277	2,352,317

Alternate #3 - Raw Water Source: ITALY / UPPER RED OAK RESERVOIR
Water Treatment Plant Service Area: Midlothian
Entities Served - Midlothian; Red Oak; Rockett

DATE OF PRINTOUT: 03/23/
TIME OF PRINTOUT: 09:1

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			0.00		0.00		1.68		4.34		6.91	
Peak	2.00		0.00		0.00		3.36		8.68		13.82	
Gross Raw Water Demand - MGD												
Average			0.97		1.54		3.95		7.55		11.19	
Peak	2.00		1.94		3.08		7.90		15.10		22.38	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir				0		11,848,000		0		0		0
Land				0		9,915,120		0		0		0
Contingency - Environmental Conflicts						4,271,990						
Sub-total Raw Water Development Costs				0		26,035,110		0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.				2	1,000,000	0	0	0	0	0	0
Land	@ $5,000/acre				10	50,000	0	0	0	0	0	0
Pump Station	@ $750/hp				300	225,000	322	241,500	986	739,500	952	714,000
Land	@ $5,000/acre				10	50,000	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0		0		0	0	0	0	0
	42	88		0		0		0	0	0	0	0
	36	76		0		0		0	0	0	0	0
	30	63		0		0	0	0	0	0	0	0
	27	57		0		0		0	0	0	0	0
	24	50		0	84,500	4,225,000		0	0	0	0	0
	20	42		0		0	0	0	0	0	0	0
	18	38		0	92,900	3,530,200		0	0	0	0	0
	16	34		0		0		0	84,500	2,873,000	0	0
	12	25	19,000	475,000		0		0	92,900	2,322,500	0	0
Right-of-Way	@ $25,000/mile		4	89,962	34	839,962	0	0	34	839,962	0	0
Sub-total Raw Water Delivery Costs								241,500		6,774,962		714,000
Treatment and Conveyance												
Treatment Plant												
Phase I	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
Phase II	@ $800,000/MGD		0.00	0	5.00	4,000,000	0.00	0	0.00	0	0.00	0
Phase III	@ $800,000/MGD		0.00	0	0.00	0	7.00	5,600,000	0.00	0	0.00	0
Phase IV	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	7.00	5,600,000	0.00	0
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		100	75,000	80	60,000	61	45,750	381	285,750	368	276,000
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101						0	0	0	0	0
	42	88						0	0	0	0	0
	36	76					0	0	0	0	0	0
	30	63					0	0	0	0	0	0
	27	57	21,100	1,308,200			21,100	1,308,200	0	0	0	0
	24	50	67,000	3,685,000			67,000	3,685,000	0	0	0	0

	20		42	67,000	3,082,000			67,000	3,082,000	0	0	0	
	18		38	43,200	1,771,200			43,200	1,771,200	0	0	0	0
	16		34							0	0	0	0
	12		25	14,800	414,400			14,800	414,400	0	0	0	0
	8		17										
Right-of-Way		@ $25,000/mile		40	1,008,996	0	0	40	1,008,996	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs					11,444,796		4,060,000		16,915,546		5,885,750		276,000
Interconnecting Lines	12"		$25					44,400	1,110,000	0	0	0	0
Right-of-Way		@ $25,000/mile						8	210,227	0	0	0	0
Sub-total Interconnecting Lines									1,320,227		0		0
TOTAL CONSTRUCTION COST					11,444,796		30,095,110		18,477,273		12,660,712		990,000
Engineering and Construction Contingency			20%		2,288,959		6,019,022		3,695,455		2,532,142		198,000
Implementation Administration			17%		2,334,738		6,139,402		3,769,364		2,582,785		201,960
Financial - Interest During Const After 1st yr			4%		642,740		1,690,141		1,037,684		711,026		55,598
TOTAL CAPITAL COST					16,711,234		43,943,675		26,979,776		18,486,665		1,445,558
TOTAL RESERVOIR COST					0		38,015,426						
ANNUAL COSTS													
Proposed System Debt Service 8.5%; 20 years	CRF= .10567				1,765,876		2,392,314		3,477,391		4,804,439		4,804,439
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08841				0		3,360,944		3,360,944		3,360,944		3,360,944
Reservoir O & M	0.2% X Reservoir cap cost x 1.2				0		28,435		28,435		28,435		28,435
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2				0		8,100		16,794		43,416		69,120
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr				0		156,839		325,180		840,657		1,338,360
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2				5,700		98,762		98,762		161,108		161,108
Water Treatment Plant O & M	$0.55/1000 gal				194,728		309,155		792,963		1,515,663		2,246,393
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2				2,700		4,860		6,507		16,794		26,730
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08+KWHR				52,280		94,103		125,994		325,180		517,569
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2				123,130		123,130		246,259		246,259		246,259
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2				0		0		13,320		13,320		13,320
Reservoir Storage Space Use Fee					0		0		0		0		0
Existing Facility Debt Service					1,265,581		1,280,431		0		0		0
SERVICE AREA ANNUAL COST					3,409,994		7,857,074		8,492,549		11,356,215		12,812,677
RAW WATER PURCHASE, UNIT COST					0.00		0.03		0.03		0.08		0.22
RAW WATER PURCHASE, ANNUAL COST					0		0		18,396		126,728		554,873
TOTAL ANNUAL COST FOR MIDLOTHIAN SERVICE AREA					3,409,994		7,857,074		8,510,945		11,482,943		13,367,550
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)					9.63		13.98		5.90		4.17		3.27

Alternate #3 - Raw Water Source: ITALY / UPPER RED OAK RESERVOIRS
Water Treatment Plant Service Area: Waxahachie
Entities Served - Waxahachie; Italy; Milford; SSC; Maypearl; Buena Vista/Bethel

DATE OF PRINTOUT: 03/1[illegible]
TIME OF PRINTOUT: 04:49 .

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			2.22		2.54		2.97		4.56		6.14	
Peak 2.00			4.44		5.08		5.94		9.12		12.28	
Gross Raw Water Demand - MGD												
Average			6.36		8.07		9.80		11.61		13.19	
Peak 2.00			12.72		16.14		19.60		23.22		26.38	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir				0		4,420,000		0		0		0
Land				0		3,371,600		0		0		0
Contingencey - Environmental Conflicts				0		2,112,628						
Sub-total Raw Water Development Costs				0		9,904,228		0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.		0	0	1	500,000	0	0	0	0	0	0
Land	@ $5,000/acre		0	0	5	25,000	0	0	0	0	0	0
Pump Station	@ $750/hp		0	0	694	520,500	106	79,500	388	291,000	412	309,000
Land	@ $5,000/acre		0	0	10	50,000	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63	0	0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50		0	60,200	3,010,000	0	0	0	0	0	0
	20	42	0	0	0	0	0	0	0	0	0	0
	18	38	32,700	1,242,600	0	0	0	0	0	0	0	0
	16	34	0	0	0	0	0	0	60,200	2,046,800	0	0
	12	25		0	0	0	0	0	0	0	0	0
Right-of-Way	@ $25,000/mile		6	154,830	11	285,038	0	0	11	285,038	0	0
Sub-total Raw Water Delivery Costs				1,397,430		4,390,538		79,500		2,622,838		309,000
Treatment and Conveyance												
Treatment Plant												
Phase I	@ $800,000/MGD		4.00	3,200,000	0.00	0	0.00	0	0.00	0	0.00	0
Phase II	@ $800,000/MGD		0.00	0	3.00	2,400,000	0.00	0	0.00	0	0.00	0
Phase III	@ $800,000/MGD		0.00	0	0.00	0	4.00	3,200,000	0.00	0	0.00	0
Phase IV	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	3.00	2,400,000	0.00	0
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		153	114,750	22	16,500	30	22,500	99	74,250	106	79,500
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57	4,200	239,400	0	0	4,200	239,400	0	0	0	0
	24	50	20,600	1,030,000	0	0	20,600	1,030,000	0	0	0	0

	20	42	9,500	399,000	0	0	9,500	399,000	0	0	0	0
	18	38		0	0	0	0	0	0	0	0	0
	16	34		0	0	0	0	0	0	0	0	0
	12	25	57,000	1,425,000	0	0	57,000	1,425,000	0	0	0	0
	8	17	51,700	878,900	0	0	51,700	878,900	0	0	0	0
Right-of-Way	@ $25,000/mile		27	677,083	0	0	27	677,083	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs				8,064,133		2,416,500		7,871,883		2,474,250		79,500
Interconnecting Lines	12"	$25	0	0	0	0	42,200	1,055,000	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	8	199,811	0	0	0	0
Sub-total Interconnecting Lines				0		0		1,254,811		0		0
TOTAL CONSTRUCTION COST				9,461,563		16,711,266		9,206,194		5,097,088		388,500
Engineering and Construction Contingency		20%		1,892,313		3,342,253		1,841,239		1,019,418		77,700
Implementation Administration		17%		1,930,159		3,409,098		1,878,064		1,039,806		79,254
Financial - Interest During Const After 1st yr		4%		531,361		938,505		517,020		286,252		21,818
TOTAL CAPITAL COST				13,815,396		24,401,122		13,442,516		7,442,564		567,272
TOTAL RESERVOIR COST				0		14,461,758						

ANNUAL COSTS

Proposed System Debt Service 8.5%; 20 years	CRF= .10567	1,459,873	2,510,165	2,470,763	2,206,926	2,206,926
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08841	0	1,278,564	1,278,564	1,278,564	1,278,564
Reservoir O & M	0.2% X Reservoir cap cost x 1.2	0	10,608	10,608	10,608	10,608
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2	0	18,738	21,600	32,076	43,200
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr	0	362,821	418,237	621,083	836,475
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2	14,911	51,031	51,031	75,593	75,593
Water Treatment Plant O & M	$0.55/1000 gal	1,276,770	1,620,053	1,967,350	2,330,708	2,647,893
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2	4,131	4,725	5,535	8,208	11,070
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08*KWHR	79,988	91,489	107,173	158,930	214,347
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2	47,668	47,668	95,335	95,335	95,335
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2	0	0	12,660	12,660	12,660
Reservoir Storage Space Use Fee		145,800	0	0	0	0
Existing Facility Debt Service		1,287,700	1,287,700	1,685,900	398,200	0
SERVICE AREA ANNUAL COST		4,316,841	7,283,562	8,124,757	7,228,891	7,432,670
RAW WATER PURCHASE, UNIT COST		0.69	0.40	0.40	0.40	0.40
RAW WATER PURCHASE, ANNUAL COST		559,107	370,840	433,620	665,760	896,440
TOTAL ANNUAL COST FOR WAXAHACHIE SERVICE AREA		4,875,948	7,654,402	8,558,377	7,894,651	8,329,110
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)		2.10	2.60	2.39	1.86	1.73

Alternate #3 - Raw Water Source: ITALY / UPPER RED OAK RESERVOIRS
Water Treatment Plant Service Area: Ennis
Entities Served - Ennis with East Garrett; Boyce; Palmer; Bristol; Ferris; Milmo

DATE OF PRINTOUT: 03/13/89
TIME OF PRINTOUT: 04:49 PM

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			0.91		1.26		2.33		4.05		5.81	
Peak 2.00			1.82		2.52		4.66		8.10		11.62	
Gross Raw Water Demand - MGD												
Average			3.74		5.48		7.04		8.76		10.52	
Peak 2.00			7.48		10.96		14.08		17.52		21.04	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir				0		4,182,000		0		0		0
Land				0		3,190,720		0		0		0
Contingency - Environmental Conflicts						2,052,938						
Sub-total Raw Water Development Costs				0		9,425,658		0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.		0	0	1	500,000	0	0	0	0	0	0
Land	@ $5,000/acre		0	0	5	25,000	0	0	0	0	0	0
Pump Station	@ $750/hp		0	0	163	122,250	138	103,500	222	166,500	227	170,250
Land	@ $5,000/acre		0	0	10	50,000	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50		0	65,500	3,275,000	0	0	0	0	0	0
	20	42		0	0	0	0	0	0	0	0	0
	18	38	0	0	0	0	0	0	0	0	0	0
	16	34		0	0	0	0	0	65,500	2,227,000	0	0
	12	25	12,700	317,500	0	0	0	0	0	0	0	0
Right-of-Way	@ $25,000/mile		2	60,133	12	310,133	0	0	12	310,133	0	0
Sub-total Raw Water Delivery Costs				377,633		4,282,383		103,500		2,703,633		170,250
Treatment and Conveyance												
Treatment Plant												
Phase I	@ $800,000/MGD		5	4000000	0	0	0	0	0	0	0	0
Phase II	@ $800,000/MGD		0	0	3	2400000	0	0	0	0	0	0
Phase III	@ $800,000/MGD		0	0	0	0	3	2400000	0	0	0	0
Phase IV	@ $800,000/MGD		0	0	0	0	0	0	4	3200000	0	0
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		43	32,250	17	12,750	50	37,500	82	61,500	83	62,250
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50	0	0	0	0	0	0	0	0	0	0

	20	42		0	0	0		0	0	0	0	0
	18	38	41,400	1,573,200	0	0	41,400	1,573,200	0	0	0	0
	16	34	65,800	2,237,200	0	0	65,800	2,237,200	0	0	0	0
	12	25	17,300	432,500	0	0	17,300	432,500	0	0	0	0
	8	17	61,500	1,045,500	0	0	61,500	1,045,500	0	0	0	0
Right-of-Way	@ $25,000/mile		35	880,682	0	0	35	880,682	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs				10,301,332		2,412,750		8,606,582		3,261,500		62,250
Interconnecting Lines	12"	$25	0	0	0	0	34,800	870,000	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	7	164,773	0	0	0	0
Sub-total Interconnecting Lines				0		0		1,034,773		0		0
TOTAL CONSTRUCTION COST				10,670,964		16,120,790		9,744,855		5,965,133		232,500
Engineering and Construction Contingency		20%		2,135,793		3,224,158		1,948,971		1,193,027		46,500
Implementation Administration		17%		2,178,509		3,288,641		1,987,950		1,216,887		47,430
Financial - Interest During Const After 1st yr		4%		599,731		905,344		547,271		335,002		13,057
TOTAL CAPITAL COST				15,592,997		23,538,933		14,229,047		8,710,048		339,487
TOTAL RESERVOIR COST				0		13,762,968						
ANNUAL COSTS												
Proposed System Debt Service 8.5%; 20 years	CRF= .10567			1,647,712		2,480,738		2,536,610		2,423,974		2,423,974
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08841			0		1,216,784		1,216,784		1,216,784		1,216,784
Reservoir O & M	0.2% X Reservoir cap cost x 1.2			0		10,037		10,037		10,037		10,037
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2			0		4,401		8,127		14,121		20,250
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr			0		85,216		157,362		273,423		392,098
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2			3,810		43,110		43,110		69,834		69,834
Water Treatment Plant O & M	$0.55/1000 gal			750,805		1,100,110		1,413,280		1,758,570		2,111,890
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2			1,161		1,620		2,970		5,184		7,425
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08*KWHR			22,480		31,368		57,508		100,377		143,769
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2			63,461		63,461		126,922		126,922		126,922
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2			0		0		10,440		10,440		10,440
Reservoir Storage Space Use Fee				25,000		0		0		0		0
Existing Facility Debt Service				967,000		967,000		1,452,800		485,800		0
SERVICE AREA ANNUAL COST				3,481,429		6,203,844		7,035,948		6,495,465		6,533,422
RAW WATER PURCHASE, UNIT COST				0.69		0.40		0.40		0.40		0.40
RAW WATER PURCHASE, ANNUAL COST				229,184		183,960		340,180		591,306		848,260
TOTAL ANNUAL COST FOR ENNIS SERVICE AREA				3,710,613		6,387,804		7,376,128		7,086,765		7,381,682
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)				2.72		3.19		2.87		2.22		1.92

REGIONAL SUMMARY
ALTERNATE #4

DATE OF PRINTOUT: 03/23/89
TIME OF PRINTOUT: 09:27 AM

Planning Year	1990	2000	2010	2020	2030
Midlothian Service Area Annual Cost	3,427,102	3,795,155	2,915,100	3,250,711	3,429,264
Waxahachie Service Area Annual Cost	4,617,277	7,122,817	7,887,971	7,107,584	7,376,481
Ennis Service Area Annual Cost	4,594,613	7,472,864	8,040,455	6,922,101	7,818,161
Red Oak Service Area Annual Cost	0	2,004,308	4,124,792	5,364,326	5,955,128
Regional Annual Cost	12,638,992	20,395,144	22,968,318	22,644,722	24,579,034
Regional Gross Demand MGD	11.07	15.09	20.79	27.92	34.90
Regional Cost per 1000 Gal	3.13	3.70	3.03	2.22	1.93
Midlothian Service Area Capital Cost	17,321,454	2,401,963	18,641,411	3,669,747	119,368
Waxahachie Service Area Capital Cost	13,306,653	22,252,179	12,678,433	8,197,879	167,553
Ennis Service Area Capital Cost	15,592,997	24,121,957	14,420,228	8,980,744	236,546
Red Oak Service Area Capital Cost	0	22,487,632	16,097,652	5,938,106	93,085
	46,221,104	71,263,731	61,837,724	26,786,476	616,552

Alternate 04 - Raw Water Source: ITALY / UPPER RED OAK RESERVOIRS & TRA CENTRAL / RED OAK WWTP REUSE
Water Treatment Plant Service Area: Midlothian
Entities Served - Midlothian; Buena Vista/Bethel; Maypearl

DATE OF PRINTOUT: 03/13/89
TIME OF PRINTOUT: 03:48 PM

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			0.32		0.48		0.70		0.96		1.22	
Peak 2.00			0.64		0.96		1.40		1.92		2.44	
Gross Raw Water Demand - MGD												
Average			1.29		2.02		2.97		4.17		5.50	
Peak 2.00			2.58		4.04		5.94		8.34		11.00	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir												
Land												
Sub-total Raw Water Development Costs												
Raw Water Delivery												
Intake Structure	@ $500,000 ea.			0		0		0		0		0
Land	@ $5,000/acre			0		0		0		0		0
Pump Station	@ $750/hp		91	68,250	46	34,500	63	47,250	115	86,250	85	63,750
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50	0	0	0	0	0	0	0	0	0	0
	20	42		0	0	0	0	0	0	0	0	0
	18	38	180,600	6,862,800	0	0	180,600	6,862,800	0	0	0	0
	16	34		0	0	0	0	0	0	0	0	0
	12	25		0	0	0	0	0	0	0	0	0
Right-of-Way	@ $25,000/mile		34	855,114	0	0	34	855,114	0	0	0	0
Sub-total Raw Water Delivery Costs				7,836,164		34,500		7,765,164		86,250		63,750
Treatment and Conveyance												
Treatment Plant												
Phase I	@ $800,000/MGD		1.00	800,000	0.00	0	0.00	0	0.00	0	0.00	0
Phase II	@ $800,000/MGD		0.00	0	2.00	1,600,000	0.00	0	0.00	0	0.00	0
Phase III	@ $800,000/MGD		0.00	0	0.00	0	2.00	1,600,000	0.00	0	0.00	0
Phase IV	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	3.00	2,400,000	0.00	0
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		28	21,000	14	10,500	18	13,500	36	27,000	24	18,000
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57	0	0	0	0	0	0	0	0	0	0
	24	50		0	0	0	0	0	0	0	0	0
	20	42		0	0	0	0	0	0	0	0	0

	18	38		0	0	0	0	0	0	0	0	0
	16	34		0	0	0	0	0	0	0	0	0
	12	25	78,200	1,955,000	0	0	78,200	1,955,000	0	0	0	0
	8	17	35,900	610,300	0	0	35,900	610,300	0	0	0	0
Right-of-Way	@ $25,000/mile		22	540,246	0	0	22	540,246	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs				4,026,546		1,610,500		4,719,046		2,427,000		18,000
Interconnecting Lines	12"	$25	0	0	0	0	9,500	237,500	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	2	44,981	0	0	0	0
Sub-total Interconnecting Lines				0		0		282,481		0		0
TOTAL CONSTRUCTION COST				11,862,710		1,645,000		12,766,691		2,513,250		81,750
Engineering and Construction Contingency		20%		2,372,542		329,000		2,553,338		502,650		16,350
Implementation Administration		17%		2,419,993		335,580		2,604,405		512,703		16,677
Financial - Interest During Const After 1st yr		4%		666,210		92,383		716,977		141,144		4,591
TOTAL CAPITAL COST				17,321,454		2,401,963		18,641,411		3,669,747		119,368
TOTAL RESERVOIR COST				0		0						

ANNUAL COSTS

Proposed System Debt Service 8.5%; 20 years	CRF= .10567	1,830,358	2,084,174	2,223,653	2,357,620	2,357,620
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08841	0	0	0	0	0
Reservoir O & M	0.2% X Reservoir cap cost x 1.2	0	0	0	0	0
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2	2,457	3,699	5,400	8,505	10,800
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr	47,575	71,623	104,559	164,681	209,119
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2	82,354	82,354	164,707	164,707	164,707
Water Treatment Plant O & M	$0.55/1000 gal	0	0	0	0	0
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2	756	1,134	1,620	2,592	3,240
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08xKWHR	14,638	21,957	31,368	50,188	62,736
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2	30,784	30,784	61,567	61,567	61,567
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2	0	0	2,850	2,850	2,850
Reservoir Storage Space Use Fee		6,600	0	0	0	0
Existing Facility Debt Service		1,265,581	1,280,431	0	0	0
SERVICE AREA ANNUAL COST		3,281,102	3,576,155	2,595,725	2,812,711	2,872,639
RAW WATER PURCHASE, UNIT COST		1.25	1.25	1.25	1.25	1.25
RAW WATER PURCHASE, ANNUAL COST		146,000	219,000	319,375	438,000	556,625
TOTAL ANNUAL COST FOR MIDLOTHIAN SERVICE AREA		3,427,102	3,795,155	2,915,100	3,250,711	3,429,264
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)		7.28	5.15	2.69	2.14	1.71

Alternate #4 - Raw Water Source: ITALY / UPPER RED OAK RESERVOIR & TRA CENTRAL / RED OAK WWTP REUSE
Water Treatment Plant Service Area: Waxahachie
Entities Served - Waxahachie; Italy; Milford; SSC

DATE OF PRINTOUT: 03/13/89
TIME OF PRINTOUT: 03:50 PM

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			1.90		2.06		2.27		3.60		4.92	
Peak	2.00		3.80		4.12		4.54		7.20		9.84	
Gross Raw Water Demand - MGD												
Average			6.04		7.59		9.10		10.65		11.97	
Peak	2.00		12.08		15.18		18.20		21.30		23.94	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir				0		3,541,000		0		0		0
Land				0		2,701,600		0		0		0
Contingency - Environmental Conflicts				0		1,891,528						
Sub-total Raw Water Development Costs				0		8,134,128		0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.		0	0	1	500,000	0	0	0	0	0	0
Land	@ $5,000/acre		0	0	5	25,000	0	0	0	0	0	0
Pump Station	@ $750/hp		0	0	181	135,750	19	14,250	93	69,750	107	80,250
Land	@ $5,000/acre		0	0	10	50,000	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50		0	72,900	3,645,000	0	0	0	0	0	0
	20	42		0	0	0	0	0	0	0	0	0
	18	38	32,700	1,242,600	0	0	0	0	72,900	2,770,200	0	0
	16	34	0	0	0	0	0	0	0	0	0	0
	12	25	0	0	0	0	0	0	0	0	0	0
Right-of-Way	@ $25,000/mile		6	154,830	14	345,170	0	0	14	345,170	0	0
Sub-total Raw Water Delivery Costs				1,397,430		4,700,920		14,250		3,185,120		80,250
Treatment and Conveyance												
Treatment Plant												
Phase I	@ $800,000/MGD		3.00	2,400,000	0.00	0	0.00	0	0.00	0	0.00	0
Phase II	@ $800,000/MGD		0.00	0	3.00	2,400,000	0.00	0	0.00	0	0.00	0
Phase III	@ $800,000/MGD		0.00	0	0.00	0	3.00	2,400,000	0.00	0	0.00	0
Phase IV	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	3.00	2,400,000	0.00	0
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		71	53,250	6	4,500	8	6,000	39	29,250	46	34,500
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50	0	0	0	0	0	0	0	0	0	0

	20	42		0	0	0	0	0	0	0	0	0
	18	38	35,900	1,471,900	0	0	35,900	1,471,900	0	0	0	0
	16	34	31,700	1,172,900	0	0	31,700	1,172,900	0	0	0	0
	12	25	42,200	1,181,600	0	0	42,200	1,181,600	0	0	0	0
	8	17	35,900	646,200	0	0	35,900	646,200	0	0	0	0
Right-of-Way	@ $25,000/mile		28	689,867	0	0	28	689,867	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs				7,715,717		2,404,500		7,568,467		2,429,250		34,500
Interconnecting Lines	12"	$25	0	0	0	0	37,000	925,000	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	7	175,189	0	0	0	0
Sub-total Interconnecting Lines				0		0		1,100,189		0		0
TOTAL CONSTRUCTION COST				9,113,147		15,239,548		8,682,907		5,614,370		114,750
Engineering and Construction Contingency		20%		1,822,629		3,047,910		1,736,581		1,122,874		22,950
Implementation Administration		17%		1,859,082		3,108,868		1,771,313		1,145,332		23,409
Financial - Interest During Const After 1st yr		4%		511,794		855,853		487,632		315,303		6,444
TOTAL CAPITAL COST				13,306,653		22,252,179		12,678,433		8,197,879		167,553
TOTAL RESERVOIR COST				0		11,877,128						

ANNUAL COSTS

Proposed System Debt Service 8.5%; 20 years	CRF= .10567	1,406,114	2,502,446	2,436,062	2,206,000	2,206,000
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08841	0	1,050,057	1,050,057	1,050,057	1,050,057
Reservoir O & M	0.2% X Reservoir cap cost x 1.2	0	8,498	8,498	8,498	8,498
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2	0	4,887	5,400	7,911	10,800
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr	0	98,626	104,559	153,179	209,119
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2	14,911	58,651	58,651	91,894	91,894
Water Treatment Plant O & M	$0.55/1000 gal	1,212,530	1,523,693	1,826,825	2,137,988	2,402,978
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2	1,917	2,079	2,295	3,348	4,590
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08*KWHR	37,119	40,255	44,438	64,827	88,875
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2	53,671	53,671	107,342	107,342	107,342
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2	0	0	11,100	11,100	11,100
Reservoir Storage Space Use Fee		124,800	0	0	0	0
Existing Facility Debt Service		1,287,700	1,287,700	1,685,900	398,200	0
SERVICE AREA ANNUAL COST		4,138,762	6,626,563	7,341,128	6,240,344	6,191,253
RAW WATER PURCHASE, UNIT COST		0.69	0.66	0.66	0.66	0.66
RAW WATER PURCHASE, ANNUAL COST		478,515	496,254	546,843	867,240	1,185,228
TOTAL ANNUAL COST FOR WAIAHACHIE SERVICE AREA		4,617,277	7,122,817	7,887,971	7,107,584	7,376,481
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)		2.09	2.57	2.37	1.83	1.69

Alternate 04 - Raw Water Source: ITALY / UPPER RED OAK RESERVOIR & TRA CENTRAL / RED OAK M. SE

DATE OF PRINTOUT: 03/2
TIME OF PRINTOUT: 08:2)

Water Treatment Plant Service Area: Ennis
Entities Served - Ennis with East Garrett; Boyce; Planer; Bristol; Ferris; Milmer

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			0.91		1.26		2.33		4.05		5.81	
Peak 2.00			1.82		2.52		4.66		8.10		11.62	
Gross Raw Water Demand - MGD												
Average			3.74		5.48		7.04		8.76		10.52	
Peak 2.00			7.48		10.96		14.08		17.52		21.04	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir				0		4,156,000		0		0		0
Land				0		3,190,720		0		0		0
Contingency - Environmental Conflicts				0		2,052,938						
Sub-total Raw Water Development Costs				0		9,399,658		0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.		0	0	1	500,000	0	0	0	0	0	0
Land	@ $5,000/acre		0	0	5	25,000	0	0	0	0	0	0
Pump Station	@ $750/hp		0	0	190	142,500	30	22,500	87	65,250	133	99,750
Land	@ $5,000/acre		0	0	10	50,000	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50		0	72,900	3,645,000	0	0	0	0	0	0
	20	42		0	0	0	0	0	0	0	0	0
	18	38		0	0	0	0	0	0	0	0	0
	16	34	0	0	0	0	0	0	72,900	2,478,600	0	0
	12	25	12,700	317,500	0	0	0	0	0	0	0	0
Right-of-Way	@ $25,000/mile		2	60,133	14	345,170	0	0	14	345,170	0	0
Sub-total Raw Water Delivery Costs				377,633		4,707,670		22,500		2,889,020		99,750
Treatment and Conveyance												
Treatment Plant												
Phase I	@ $800,000/MGD		5	4,000,000	0	0	0	0	0	0	0	0
Phase II	@ $800,000/MGD		0	0	3	2,400,000	0	0	0	0	0	0
Phase III	@ $800,000/MGD		0	0	0	0	3	2,400,000	0	0	0	0
Phase IV	@ $800,000/MGD		0	0	0	0	0	0	4	3,200,000	0	0
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		43	32,250	17	12,750	50	37,500	82	61,500	83	62,250
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50	0	0	0	0	0	0	0	0	0	0

	20	42		-	0	0	0	0	0	0	0	
	18	38	41,400	1,573,200	0	0	41,400	1,573,200	0	0	0	0
	16	34	65,800	2,237,200	0	0	65,800	2,237,200	0	0	0	0
	12	25	17,300	432,500	0	0	17,300	432,500	0	0	0	0
	8	17	61,500	1,045,500	0	0	61,500	1,045,500	0	0	0	0
Right-of-Way	@ $25,000/mile	35		880,682	0	0	33	825,000	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs				10,301,332		2,412,750		8,550,900		3,261,500		62,250
Interconnecting Lines	12"	$25	0	0	0	0	43,800	1,095,000	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	8	207,386	0	0	0	0
Sub-total Interconnecting Lines				0		0		1,302,386		0		0
TOTAL CONSTRUCTION COST				10,678,964		16,520,078		9,875,786		6,150,520		162,000
Engineering and Construction Contingency		20%		2,135,793		3,304,016		1,975,157		1,230,104		32,400
Implementation Administration		17%		2,178,509		3,370,096		2,014,660		1,254,706		33,048
Financial - Interest During Const After 1st yr		4%		599,731		927,768		554,624		345,413		9,098
TOTAL CAPITAL COST				15,592,997		24,121,957		14,420,228		8,980,744		236,546
TOTAL RESERVOIR COST				0		13,725,004						

ANNUAL COSTS

Proposed System Debt Service 8.5%; 20 years	CRF= .10567	1,647,712	2,746,358	2,622,432	2,472,781	2,472,781
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08841	0	1,213,428	1,213,428	1,213,428	1,213,428
Reservoir O & M	0.2% X Reservoir cap cost x 1.2	0	9,974	9,974	9,974	9,974
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2	0	5,130	5,940	8,289	11,880
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr	0	99,331	115,015	160,499	230,031
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2	3,810	47,550	47,550	77,293	77,293
Water Treatment Plant O & M	$0.55/1000 gal	750,805	1,100,110	1,413,280	1,758,570	2,111,890
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2	1,161	1,620	2,970	5,184	7,425
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08*KWHR	22,480	31,368	57,508	100,377	143,769
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2	63,461	63,461	126,922	126,922	126,922
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2	0	0	13,140	13,140	13,140
Reservoir Storage Space Use Fee		25,000	0	0	0	0
Existing Facility Debt Service		1,851,000	1,851,000	1,851,000	0	0
SERVICE AREA ANNUAL COST		4,365,429	7,169,330	7,479,158	5,946,456	6,418,532
RAW WATER PURCHASE, UNIT COST		0.69	0.66	0.66	0.66	0.66
RAW WATER PURCHASE, ANNUAL COST		229,184	303,534	561,297	975,645	1,399,629
TOTAL ANNUAL COST FOR ENNIS SERVICE AREA		4,594,613	7,472,864	8,040,455	6,922,101	7,818,161
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)		3.37	3.74	3.13	2.16	2.04

Alternate 04 - Raw Water Source: ITALY / UPPER RED OAK RESERVOIR & TRA CENTRAL / RED OAK Wa.. ..USE
Water Treatment Plant Service Areas: Red Oak
Entities Served - Red Oak; Rockett

DATE OF PRINTOUT: 03/1
TIME OF PRINTOUT: 09:10 AM

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			0.00		0.00		1.68		4.34		6.91	
Peak 2.00			0.00		0.00		3.36		8.68		13.82	
Gross Raw Water Demand - MGD												
Average			0.00		0.00		1.68		4.34		6.91	
Peak 2.00			0.00		0.00		3.36		8.68		13.82	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir				0		6,740,000		0		0		0
Land				0		5,760,000		0		0		0
Contingency - Environmental Conflicts				0		2,900,800		0				
Sub-total Raw Water Development Costs				0		15,400,800		0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.						1	500,000	0	0	0	0
Land	@ $5,000/acre						5	25,000	0	0	0	0
Pump Station	@ $750/hp						23	17,250	37	27,750	35	26,250
Land	@ $5,000/acre						10	50,000	0	0	0	0
Pipeline	Size	$/LF										
	48	101						0		0		0
	42	88						0		0		0
	36	76						0		0		0
	30	63						0		0		0
	27	57						0		0		0
	24	50						0		0		0
	20	42					3,200	134,400	0	0	0	0
	18	38						0		0		0
	16	34						0		0		0
	12	25						0		0		0
Right-of-Way	@ $25,000/mile						1	15,152	0	0	0	0
Sub-total Raw Water Delivery Costs				0		0		741,802		27,750		26,250
Treatment and Conveyance												
Treatment Plant												
Phase I	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
Phase II	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
Phase III	@ $800,000/MGD		0.00	0	0.00	0	9.00	7,200,000	0.00	0	0.00	0
Phase IV	@ $800,000/MGD		0.00	0	0.00	0	0.00	0	5.00	4,000,000	0.00	0
Land	@ $5,000/acre						10	50,000	0	0	0	0
Pump Station	@ $750/hp						33	24,750	52	39,000	50	37,500
Land	@ $5,000/acre						10	50,000	0	0	0	0
Pipeline	Size	$/LF										
	48	101						0		0		0
	42	88						0		0		0
	36	76						0		0		0
	30	63					12,700	800,100	0	0	0	0
	27	57						0		0		0
	24	50					10,000	500,000	0	0	0	0

Raw

	20	42				0		0		
	18	38				0		0		0
	16	34			8,400	285,600	0	0	0	0
	12	25				0		0		0
	8	17				0		0		0
Right-of-Way	@ $25,000/mile				6	147,254	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs			0	0		9,057,704		4,039,000		37,500
Interconnecting Lines	12"	$25			41,200	1,030,000	0	0	0	0
Right-of-Way	@ $25,000/mile				8	195,076	0	0	0	0
Sub-total Interconnecting Lines			0	0		1,225,076		0		0
TOTAL CONSTRUCTION COST			0	15,400,800		11,024,581		4,046,750		63,750
Engineering and Construction Contingency		20%	0	3,080,160		2,204,916		813,350		12,750
Implementation Administration		17%	0	3,141,763		2,249,015		829,617		13,005
Financial - Interest During Const After 1st yr		4%	0	864,909		619,140		228,389		3,580
TOTAL CAPITAL COST			0	22,487,632		16,097,652		5,938,106		93,085
TOTAL RESERVOIR COST			0	22,487,632						
ANNUAL COSTS										
Proposed System Debt Service 8.5%; 20 years	CRF= .10567		0	0		1,701,039		2,328,519		2,328,519
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08841		0	1,988,132		1,988,132		1,988,132		1,988,132
Reservoir O & M	0.2% X Reservoir cap cost x 1.2		0	16,176		16,176		16,176		16,176
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2		0	0		621		1,620		2,565
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr		0	0		12,024		31,368		49,666
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2		0	0		1,613		1,613		1,613
Water Treatment Plant O & M	$0.55/1000 gal		0	0		337,260		871,255		1,387,183
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2		0	0		891		2,295		3,645
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08*KWHR		0	0		17,252		44,438		70,578
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2		0	0		19,028		19,028		19,028
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2		0	0		12,360		12,360		12,360
Reservoir Storage Space Use Fee			0	0		0		0		0
Existing Facility Debt Service			0	0		0		0		0
SERVICE AREA ANNUAL COST			0	2,004,308		4,106,396		5,314,803		5,879,463
RAW WATER PURCHASE, UNIT COST			0.00	0.00		0.03		0.03		0.03
RAW WATER PURCHASE, ANNUAL COST			0	0		18,396		47,523		75,665
TOTAL ANNUAL COST FOR RED OAK SERVICE AREA			0	2,004,308		4,124,792		5,364,326		5,955,128
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)						6.73		3.39		2.36

REGIONAL SUMMARY
ALTERNATE #5

DATE OF PRINTOUT: 03/23/89
TIME OF PRINTOUT: 09:50 AM

Planning Year	1990	2000	2010	2020	2030
Midlothian Service Area Annual Cost	3,316,137	3,992,288	6,941,326	9,466,271	11,639,514
Waxahachie Service Area Annual Cost	4,662,926	10,171,905	11,066,147	10,118,346	10,344,625
Ennis Service Area Annual Cost	4,594,613	9,298,435	9,595,228	8,018,642	8,470,405
Regional Annual Cost	12,573,676	23,462,628	27,602,701	27,603,259	30,454,544
Regional Gross Demand MGD	11.07	15.09	20.79	27.92	34.90
Regional Cost per 1000 Gal	3.11	4.26	3.64	2.71	2.39
Midlothian Service Area Capital Cost	15,304,735	5,878,969	40,100,209	8,806,225	610,712
Waxahachie Service Area Capital Cost	12,960,520	56,450,500	13,350,526	13,277,297	4,317,077
Ennis Service Area Capital Cost	15,592,997	48,541,355	14,128,296	9,121,289	157,697
	43,858,252	110,870,824	67,579,031	31,204,811	5,085,486

)ernate 05 - Raw Water Source: LOWER RED OAK / BEAR CREEK RESERVOIRS; TRA CENTRAL / RED OAK)EUSE
ater Treatment Plant Service Area: Midlothian
Entities Served - Midlothian; Red Oak; Rockett

DATE OF PRINTOUT: 03/13/F
TIME OF PRINTOUT: 04:05 P.

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			0.00		0.00		1.68		4.34		6.91	
Peak	2.00		0.00		0.00		3.36		8.68		13.82	
Gross Raw Water Demand - MGD												
Average			0.97		1.54		3.95		7.55		11.19	
Peak	2.00		1.94		3.08		7.90		15.10		22.38	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir								0		0		0
Land								0		0		0
Sub-total Raw Water Development Costs								0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.						0	0	0	0	0	0
Land	@ $5,000/acre						0	0	0	0	0	0
Pump Station	@ $750/hp						80	60,000	127	95,250	123	92,250
Land	@ $5,000/acre						10	50,000	0	0	0	0
Pipeline	Size	$/LF										
	48	101						0	0	0	0	0
	42	88						0	0	0	0	0
	36	76						0	0	0	0	0
	30	63						0	0	0	0	0
	27	57						0	0	0	0	0
	24	50					180,600	9,030,000	0	0	0	0
	20	42						0	0	0	0	0
	18	38						0	0	0	0	0
	16	34						0	0	0	0	0
	12	25						0	0	0	0	0
Right-of-Way	@ $25,000/mile						34	855,114	0	0	0	0
Sub-total Raw Water Delivery Costs								9,995,114		95,250		92,250
Treatment and Conveyance												
Treatment Plant												
Phase I	@ $800,000/MGD		0	0	0	0	0	0	0	0	0	0
Phase II	@ $800,000/MGD		0	0	5	4000000	0	0	0	0	0	0
Phase III	@ $800,000/MGD		0	0	0	0	7	5600000	0	0	0	0
Phase IV	@ $800,000/MGD		0	0	0	0	0	0	7	5600000	0	0
Land	@ $5,000/acre		0	0	0	0	10	50,000	10	50,000	10	50,000
Pump Station	@ $750/hp		59	44,250	35	26,250	147	110,250	381	285,750	368	276,000
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101						0	0	0	0	0
	42	88						0	0	0	0	0
	36	76	0	0	0	0	0	0	0	0	0	0
	30	63	0	0	0	0	0	0	0	0	0	0
	27	57	21,100	1,202,700	0	0	21,100	1,202,700	0	0	0	0
	24	50	67,000	3,350,000	0	0	67,000	3,350,000	0	0	0	0

	20	42	67,000	2,814,000	0	0	67,000	2,814,000	0	0	0	0
	18	38	43,200	1,641,600	0	0	43,200	1,641,600	0	0	0	0
	16	34	0	0	0	0	0	0	0	0	0	0
	12	25	14,800	370,000	0	0	14,800	370,000	0	0	0	0
Right-of-Way	@ $25,000/mile	40		1,008,996	0	0	40	1,008,996	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs				10,481,546		4,026,250		16,147,546		5,935,750		326,000
Interconnecting Lines	12"	$25					44,400	1,110,000	0	0	0	0
Right-of-Way	@ $25,000/mile						8	210,227	0	0	0	0
Sub-total Interconnecting Lines								1,320,227		0		0
TOTAL CONSTRUCTION COST				10,481,546		4,026,250		27,462,887		6,031,000		418,250
Engineering and Construction Contingency		20%		2,096,309		805,250		5,492,577		1,206,200		83,650
Implementation Administration		17%		2,138,235		821,355		5,602,429		1,230,324		85,323
Financial - Interest During Const After 1st yr		4%		588,644		226,114		1,542,316		338,701		23,489
TOTAL CAPITAL COST				15,304,735		5,878,969		40,100,209		8,806,225		610,712
TOTAL RESERVOIR COST				0		0						

ANNUAL COSTS

Proposed System Debt Service 8.5%; 20 years	CRF= .10567	1,617,251	2,238,482	4,858,620	5,167,943	5,167,943
Proposed Reservoir Debt Service 9.5%, 40 years	CRF= .09841	0	0	0	0	0
Reservoir O & M	0.2% X Reservoir cap cost x 1.2	0	0	0	0	0
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2	0	0	2,160	5,589	8,910
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr	0	0	41,824	108,219	172,523
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2	0	0	108,360	108,360	108,360
Water Treatment Plant O & M	$0.55/1000 gal	194,728	309,155	792,963	1,515,663	2,246,393
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2	1,593	2,538	6,507	16,794	26,730
Treated Water Pump Station Energy	hp x .746x8760 x$0.08*KWHR	30,845	49,143	125,994	325,180	517,569
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2	112,540	112,540	225,079	225,079	225,079
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2	0	0	13,320	13,320	13,320
Reservoir Storage Space Use Fee		93,600	0	0	0	0
Existing Facility Debt Service		1,265,581	1,280,431	0	0	0
SERVICE AREA ANNUAL COST		3,316,137	3,992,288	6,174,826	7,486,146	8,486,826
RAW WATER PURCHASE, UNIT COST		1.25	1.25	1.25	1.25	1.25
RAW WATER PURCHASE, ANNUAL COST		0	0	766,500	1,980,125	3,152,688
TOTAL ANNUAL COST FOR MIDLOTHIAN SERVICE AREA		3,316,137	3,992,288	6,941,326	9,466,271	11,639,514
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)		9.37	7.10	4.81	3.44	2.85

Alternate #5 - Raw Water Source: LOWER RED OAK / BEAR CREEK RESERVOIRS; TRA CENTRAL / AK WWTP REUSE
Water Treatment Plant Service Area: Waxahachie
Entities Served - Waxahachie; Italy; Milford; SSC; Maypearl; Buena Vista/Bethel

DATE OF PRINTOUT: 89
TIME OF PRINTOUT: 09:58 AM

Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			2.22		2.54		2.97		4.56		6.14	
Peak 2.00			4.44		5.08		5.94		9.12		12.28	
Gross Raw Water Demand - MGD												
Average			6.04		7.59		9.10		10.65		11.97	
Peak 2.00			12.08		15.18		18.20		21.30		23.94	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir				0		11,966,000		0		0		0
Land				0		10,704,960		0		0		0
Contingency - Environmental Conflicts				0		4532636.8						
Sub-total Raw Water Development Costs				0		27,203,597		0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.		0	0	1	500,000	0	0	0	0	0	0
Land	@ $5,000/acre		0	0	5	25,000	0	0	0	0	0	0
Pump Station	@ $750/hp		0	0	128	96,000	22	16,500	72	54,000	78	58,500
Land	@ $5,000/acre		0	0	10	50,000	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	17,500	1,330,000	0	0	0	0	0	0
	30	63	0	0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50	0	0	75,600	3,780,000	0	0	0	0	0	0
	20	42		0	0	0	0	0	17,500	735,000	0	0
	18	38	19,000	722,000	0	0	0	0	0	0	0	0
	16	34		0	0	0	0	0	75,600	2,570,400	0	0
	12	25		0	0	0	0	0	0	0	0	0
Right-of-Way	@ $25,000/mile		4	89,962	18	440,814	0	0	18	440,814	0	0
Sub-total Raw Water Delivery Costs				811,962		6,221,814		16,500		3,800,214		58,500
Treatment and Conveyance												
Treatment Plant												
Phase I	@ $800,000/MGD		4	3,200,000	0	0	0	0	0	0	0	0
Phase II	@ $800,000/MGD		0	0	3	2,400,000	0	0	0	0	0	0
Phase III	@ $800,000/MGD		0	0	0	0	4	3,200,000	0	0	0	0
Phase IV	@ $800,000/MGD		0	0	0	0	0	0	3	2,400,000	0	0
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		153	114,750	22	16,500	30	22,500	99	74,250	106	79,500
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57	4,200	239,400	0	0	4,200	239,400	0	0	0	0
	24	50	20,600	1,030,000	0	0	20,600	1,030,000	0	0	0	0

	20	42	9,500	399,000	0	0	9,500	399,000	0	0	0	
	18	38		0	0	0	0	0	0	0	0	0
	16	34		0	0	0	0	0	0	0	0	0
	12	25	57,000	1,425,000	57,000	1,425,000	57,000	1,425,000	57,000	1,425,000	57,000	1,425,000
	8	17	51,700	878,900	51,700	878,900	51,700	878,900	51,700	878,900	51,700	878,900
Right-of-Way	@ $25,000/mile		27	677,083	21	514,678	27	677,083	21	514,678	21	514,678
Sub-total Treatment & Conveyance Construction Costs				8,064,133		5,235,078		7,871,883		5,292,828		2,898,078
Interconnecting Lines	12"	$25	0	0	0	0	42,200	1,055,000	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	8	199,811	0	0	0	0
Sub-total Interconnecting Lines				0		0		1,254,811		0		0
TOTAL CONSTRUCTION COST				8,876,095		38,660,489		9,143,194		9,093,042		2,956,578
Engineering and Construction Contingency		20%		1,775,219		7,732,098		1,828,639		1,818,608		591,316
Implementation Administration		17%		1,810,723		7,886,740		1,865,212		1,854,981		603,142
Financial - Interest During Const After 1st yr		4%		498,482		2,171,173		513,482		510,665		166,041
TOTAL CAPITAL COST				12,960,520		56,450,500		13,350,526		13,277,297		4,317,077
TOTAL RESERVOIR COST				0		39,721,604						
ANNUAL COSTS												
Proposed System Debt Service 8.5%; 20 years	CRF= .10567			1,369,538		3,137,281		3,178,493		2,813,762		2,813,762
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08841			0		3,511,787		3,511,787		3,511,787		3,511,787
Reservoir O & M	0.2% X Reservoir cap cost x 1.2			0		28,718		28,718		28,718		28,718
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2			0		3,456		4,050		5,994		8,100
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr			0		66,918		78,420		116,061		156,839
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2			8,664		69,984		69,984		109,649		109,649
Water Treatment Plant O & M	$0.55/1000 gal			1,212,530		1,523,693		1,826,825		2,137,988		2,402,978
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2			4,131		4,725		5,535		8,208		11,070
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08*KWHR			79,988		91,489		107,173		158,930		214,347
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2			47,668		75,314		122,982		150,629		178,276
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2			0		0		12,660		12,660		12,660
Reservoir Storage Space Use Fee				93,600		0		0		0		0
Existing Facility Debt Service				1,287,700		1,287,700		1,685,900		398,200		0
SERVICE AREA ANNUAL COST				4,103,819		9,801,065		10,632,527		9,452,586		9,448,185
RAW WATER PURCHASE, UNIT COST				0.69		0.40		0.40		0.40		0.40
RAW WATER PURCHASE, ANNUAL COST				559,107		370,840		433,620		665,760		896,440
TOTAL ANNUAL COST FOR WAXAHACHIE SERVICE AREA				4,662,926		10,171,905		11,066,147		10,118,346		10,344,625
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)				2.12		3.67		3.33		2.60		2.37

Alternate #5 - Raw Water Source: LOWER RED OAK / BEAR CREEK RESERVOIRS; TRA CENTRAL / RED OAK WWTP REUSE
Water Treatment Plant Service Area: Ennis
Entities Served - Ennis with East Garrett; Boyce; Palmer; Bristol; Ferris; Milmer

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Planning Year			1990		2000		2010		2020		2030	
New Raw Water Demand - MGD												
Average			0.91		1.26		2.33		4.05		5.81	
Peak	2.00		1.82		2.52		4.66		8.10		11.62	
Gross Raw Water Demand - MGD												
Average			3.74		5.48		7.04		8.76		10.52	
Peak	2.00		7.48		10.96		14.08		17.52		21.04	
CAPITAL COSTS			Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars	Units	Dollars
Raw Water Costs - Source Development												
Reservoir				0		11,323,000		0		0		0
Land				0		10,119,088		0		0		0
Contingency - Environmental Conflicts				0		4,339,299						
Sub-total Raw Water Development Costs				0		25,781,387		0		0		0
Raw Water Delivery												
Intake Structure	@ $500,000 ea.		0	0	1	500,000	0	0	0	0	0	0
Land	@ $5,000/acre		0	0	5	25,000	0	0	0	0	0	0
Pump Station	@ $750/hp		0	0	54	40,500	46	34,500	39	29,250	61	45,750
Land	@ $5,000/acre		0	0	10	50,000	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	17,500	1,330,000	0	0	0	0	0	0
	30	63	0	0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50	0	0	55,200	2,760,000	0	0	0	0	0	0
	20	42		0	0	0	0	0	17,500	735,000	0	0
	18	38	0	0	0	0	0	0	0	0	0	0
	16	34		0	0	0	0	0	55,200	1,876,800	0	0
	12	25	12,700	317,500	0	0	0	0	0	0	0	0
Right-of-Way	@ $25,000/mile		2	60,133	14	344,223	0	0	14	344,223	0	0
Sub-total Raw Water Delivery Costs				377,633		5,049,723		34,500		2,985,273		45,750
Treatment and Conveyance												
Treatment Plant												
Phase I	@ $800,000/MGD		5	4000000	0	0	0	0	0	0	0	0
Phase II	@ $800,000/MGD		0	0	3	2400000	0	0	0	0	0	0
Phase III	@ $800,000/MGD		0	0	0	0	3	2400000	0	0	0	0
Phase IV	@ $800,000/MGD		0	0	0	0	0	0	4	3200000	0	0
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pump Station	@ $750/hp		43	32,250	17	12,750	50	37,500	82	61,500	83	62,250
Land	@ $5,000/acre		10	50,000	0	0	0	0	0	0	0	0
Pipeline	Size	$/LF										
	48	101		0	0	0	0	0	0	0	0	0
	42	88		0	0	0	0	0	0	0	0	0
	36	76		0	0	0	0	0	0	0	0	0
	30	63		0	0	0	0	0	0	0	0	0
	27	57		0	0	0	0	0	0	0	0	0
	24	50	0	0	0	0	0	0	0	0	0	0

	20	42		0	0	0		0	0	0	0	0
	18	38	41,400	1,573,200	0	0	41,400	1,573,200	0	0	0	0
	16	34	65,800	2,237,200	0	0	65,800	2,237,200	0	0	0	0
	12	25	17,300	432,500	0	0	17,300	432,500	0	0	0	0
	8	17	61,500	1,045,500	0	0	61,500	1,045,500	0	0	0	0
Right-of-Way	@ $25,000/mile		35	880,682	0	0	35	880,682	0	0	0	0
Sub-total Treatment & Conveyance Construction Costs				10,301,332		2,412,750		8,606,582		3,261,500		62,250
Interconnecting Lines	12"	$25	0	0	0	0	34,800	870,000	0	0	0	0
Right-of-Way	@ $25,000/mile		0	0	0	0	7	164,773	0	0	0	0
Sub-total Interconnecting Lines				0		0		1,034,773		0		0
TOTAL CONSTRUCTION COST				10,678,964		33,243,861		9,675,855		6,246,773		108,000
Engineering and Construction Contingency		20%		2,135,793		6,648,772		1,935,171		1,249,355		21,600
Implementation Administration		17%		2,178,509		6,781,748		1,973,874		1,274,342		22,032
Financial - Interest During Const After 1st yr		4%		599,731		1,866,975		543,396		350,819		6,065
TOTAL CAPITAL COST				15,592,997		48,541,355		14,128,296		9,121,289		157,697
TOTAL RESERVOIR COST				0		37,644,950						

ANNUAL COSTS

Proposed System Debt Service 8.5%; 20 years	CRF= .10567	1,647,712	2,799,135	2,644,360	2,456,784	2,456,784
Proposed Reservoir Debt Service 8.5%, 40 years	CRF= .08841	0	3,328,190	3,328,190	3,328,190	3,328,190
Reservoir O & M	0.2% X Reservoir cap cost x 1.2	0	27,175	27,175	27,175	27,175
Raw Water Pump Station O & M	3% x RWPS cap cost x 1.2	0	1,458	2,700	3,753	5,400
Raw Water Pump Station Energy	hp x .746x8760 x$0.08/kwhr	0	28,231	52,280	72,669	104,559
Raw Water Pipeline O & M	1% X RW Pipeline Cap cost x 1.2	3,810	52,890	52,890	84,232	84,232
Water Treatment Plant O & M	$0.55/1000 gal	750,805	1,100,110	1,413,280	1,758,570	2,111,890
Treated Water Pump Station O & M	3% x TWPS cap costs x 1.2	1,161	1,620	2,970	5,184	7,425
Treated Water Pump Station Energy	hp x .746x8760 x$0.0.08xKWHR	22,480	31,368	57,508	100,377	143,769
Treated Water Pipeline O & M	1% X TW Pipeline Cap cost x 1.2	63,461	63,461	126,922	126,922	126,922
Interconnection Line O & M	1% X TW Interline Cap cost x 1.2	0	0	10,440	10,440	10,440
Reservoir Storage Space Use Fee		25,000	0	0	0	0
Existing Facility Debt Service		1,851,000	1,851,000	1,851,000	0	0
SERVICE AREA ANNUAL COST		4,365,429	9,284,638	9,569,714	7,974,295	8,406,786
RAW WATER PURCHASE, UNIT COST		0.69	0.03	0.03	0.03	0.03
RAW WATER PURCHASE, ANNUAL COST		229,184	13,797	25,514	44,348	63,619
TOTAL ANNUAL COST FOR ENNIS SERVICE AREA		4,594,613	9,298,435	9,595,228	8,018,642	8,470,405
UNIT COST FOR TREATED/DELIVERED WATER ($/1000 gal)		3.37	4.65	3.73	2.51	2.21

CHAPTER 363

RULES RELATING TO FINANCIAL PROGRAMS

INTRODUCTORY PROVISIONS
Texas Administrative Code Sections 363.1-363.4

The following rules are promulgated under the authority of Section 6.101, Texas Water Code.

§363.1. Scope of Rules. These sections, adopted pursuant to the Texas Water Code, §6.101, shall govern the board's Water Loan Assistance Program, Water Development Program, Water, Wastewater and Storage Facilities Acquisition Program, Water Quality Enhancement Program, and Flood Control Program as authorized by the constitution of the State of Texas, Article III, §§49-c, 49-d, 49-d-1, 49-d-2, and 49-d-3 and Texas the Water Code, Chapters 15, 16, and 17.

§363.2. Definitions of Terms. The following words and terms, when used in this chapter, shall have the following meanings, unless the context clearly indicates otherwise.

Applicant - Any participating political subdivision or group of participating political subdivisions who shall formally petition the board for approval with respect to a particular project, proposal, or request by filing the necessary application documents required by these sections.

Board - The Texas Water Development Board.

Change order - The documents issued by the participating political subdivision, with concurrence of the contractor upon recommendation of the project engineer and with the approval and consent of the executive administrator, development fund manager, board and/or commission, as may be appropriate, authorizing a change, alteration, or variance in previously approved engineering plans and specifications, including, but not limited to, additions or deletions of work to be performed pursuant to the contract or a change in costs for work performed pursuant to the contract.

Client - A storage client, water client, water treatment client, or wastewater client.

Closing or date of closing - The time of actual transfer of funds from the board to a participating political subdivision for purposes of developing, constructing, or acquiring a project.

Commission - The Texas Water Commission or its predecessors.

Conservation - The development of water resources; and those practices, techniques, and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses.

Construction - Any one or more of the following:

(A) preliminary planning to determine the feasibility of a project;

(B) engineering, architectural, environmental, legal, title, fiscal, or economic studies;

PROCEDURE FOR STATE ACQUISITION INITIATED BY THE BOAPD
Texas Administrative Code Section 363.141

The following rule is promulgated under the authority of Section 6.101, Texas Water Code.

§363.141. General. The board may initiate proceedings for state acquisition under Texas Water Code, §16.131 and §16.132, in an eligible project. The procedures governing state participation in such instances shall be established by the board for each project and shall be consistent with the requirements of Texas Water Code, Chapter 16, Subchapter E.

The board shall provide the water client reasonable notice of the board's consideration of termination of the water supply contract. This provision shall not be applicable to transfer agreement by which the board sells an ownership interest in a storage facility;

(8) other provisions appropriate to the subject of the transfer agreement including provisions setting standards for operation and maintenance of the project.

(b) The attorney general of Texas shall approve as to legality any contract authorized under this subchapter.

POST-CONSTRUCTION RESPONSIBILITIES COMPLIANCE PROCEDURE
Texas Administrative Code Section 363.181

The following rule is promulgated under the authority of Section 6.101, Texas Water Code.

§363.181. General Responsibilities. After the satisfactory completion of the project, the participating political subdivisions shall be held accountable by the board for the continued validity of all representations and assurances made to the board. Continuing cooperation with the board is expected. To facilitate such cooperation and to enable the board to protect the state's monetary investment and the public interest, the following provisions shall be observed:

(1) operation and maintenance requirements. The executive administrator is authorized to inspect the project and the records of operation and maintenance of the project at any time. If it is found that the project is being improperly or inadequately operated and maintained to the extent that the project purposes are not being properly fulfilled or that integrity of the state's investment is being endangered, the executive administrator shall require the participating political subdivisions to take corrective action;

(2) financial requirements. The development fund manager may request certified copies of all minutes, operating budgets, monthly operating statements, contracts, leases, deeds, audit reports, and other documents concerning the operation and maintenance of the project in addition to the requirements of the covenants of the bond indenture and/or the master agreement. The financial assistance provided by the board is based on the project's economic feasibility, and the board shares the participating political subdivision's desire to maintain this feasibility in the project's operation and maintenance at all times. The development fund manager shall periodically inspect, analyze, and monitor the project's revenues, operation, and any other information the board requires in order to perform its duties and to protect the public interest.

(3) water conservation reporting. Applicants with required water conservation programs shall report annually to the executive administrator on the implementation, status, and effectivenss of the water conservation programs until all of their

financial obligations to the state have been discharged. The executive administrator may require a political subdivision which is not effectively implementing its conservation program to take corrective action. The executive administrator may refer further noncompliance by a political subdivision to the attorney general, or may take other corrective actions deemed appropriate to assure compliance.

(C) surveys, designs, plans, working drawings, specifications, procedures;
(D) any condemnation or other legal proceeding; and
(E) erection, building, acquisition, alteration, remodeling, improvement or extension of a project or the inspection or supervision of any of the foregoing items.

Development funds - Such monies as are accumulated in the treasury of the State of Texas from the sale of Texas water development bonds authorized by the Texas Constitution, Article III, §49-c and §49-d and from bonds dedicated to use for the purposes of those sections under the Texas Constitution, Article III, §49-d-2.

Direct cost - The principal amount the board pays or agrees to pay for the state's interest in facilities acquired by the board.

Financial assistance - Loans by the board pursuant to the Texas Water Code, Chapters 15 and 17, or state facilities acquisition pursuant to the Texas Water Code, Chapter 16.

Firm annual yield - The amount of water that can be supplied annually from a reservoir under the minimum streamflow conditions during a recurrence of the historical drought of record.

Flood control program - The procedure for the investment of flood control funds by the purchase of bonds or other obligations of a political subdivision to finance a project for flood control as authorized by the Texas Constitution, Article III, §49-d-2 and by the Texas Water Code, Chapter 17, Subchapter H.

Master agreement - The agreement between the board and the participating political subdivision for a project in which the board had acquired or is to acquire an interest.

Net effective interest rate - The rate of interest computed by dividing the total value of all interest coupons attached to the bonds included in an issue after deducting all premiums and adding all discounts involved by the total number of years from the date of issuance to the date of maturity of each bond included in the issue.

Optimum development - The project that will develop the water resources at a site giving consideration to maximum yield, efficiency, economics, environmental concerns, and projected long-range water needs of the region.

Participating political subdivision - Any political subdivision or body politic and corporate of the State of Texas which proposes to obligate itself in a particular project and seeks the board's participation under the Water Loan Assistance Program, Water Development Program, Water, Wastewater, and Storage Facilities Acquisition Program, Flood Control Program, and/or the Water Quality Enhancement Program, including, but without limitation, any type of authority or district created or organized pursuant to the provisions of the Constitution of the State of Texas, Article III, §52 or Article XVI, §59; any interstate compact commission to which the State of Texas is a party; any municipal corporation or city,

whether operating under the Constitution of the State of Texas, Article XI, §5 (Home Rule Amendment), or under the general law; any county; and any nonprofit water supply corporation created and operating pursuant to Texas Civil Statutes, Article 1434a.

Permit - Includes any one of the following:

(A) the authority granted by the commission to appropriate, divert, and use state waters;

(B) the authority granted by the commission to construct a dam and reservoir;

(C) the authority granted by the commission to establish the treatment which shall be given to and the conditions under which waste may be discharged into or adjacent to waters in the state; and

(D) plan approval required by the Texas Water Code, §16.236, for projects that change the flood waters of a stream.

Project - Any engineering undertaking, acquisition or construction for the purpose of any one or more of the following, as applied to the Water Loan Assistance Program, Water Development Program, Water, Wastewater, and Storage Facilities Acquisition Program, Water Quality Enhancement Program, or Flood Control Program, as may be appropriate:

(A) conservation and development of the surface or subsurface water resources in the State of Texas, including the control, storage, and preservation of its storm and flood waters and waters of its rivers and streams for all useful and lawful purposes by the acquisition, improvement, extension, or construction of dams, reservoirs, and other water storage facilities, including underground storage and the acquisition or purchase of rights in the underground water and the drilling of wells;

(B) development of the saline and brackish water resources in the state, including any system necessary for desalting;

(C) transportation of water, including any system necessary for the transporting of water to filtration and treatment plants or from filtration and treatment plants to storage, including facilities for transporting waters from such storage or plants to wholesale purchasers;

(D) water treatment, including filtration and water treatment plants and wastewater treatment plants;

(E) treatment works, including any devices and systems used in the storage, treatment, recycling, and reclamation of waste or which are necessary to recycle or reuse water at the most

economical cost over the estimated life of the works;

(F) structural and nonstructural flood control and drainage facilities, including any property and any system of canals, drainage channels, dams, reservoirs, detention ponds, siphons, or combinations thereof, intended to protect human life or property or essential as an integral part of other kinds of projects eligible for financial assistance.

Project engineer - The engineer or engineering firm retained by the applicant to provide complete professional engineering services during the planning, design, and construction of the project.

Regional facility - A water supply, wastewater collection and treatment, or other system which incorporates multiple service areas or drainage areas into an areawide service facility, thereby reducing the number of required facilities, or any system which serves an area that is other than a single county, city, special district, or other political subdivision of the state, the specified size of which is determined by any one or combination of population, number of governmental entities served, and/or service capacity. Regional wastewater treatment facilities may also include those identified in the approved state water quality management plan and the annual updates to that plan.

Storage client - Any person acting within his authority who acquires or seeks to acquire by purchase, transfer, or lease all or any part of the storage facilities owned by the state in a particular reservoir.

Storage facilities - The whole or any definable part or portion of a dam or reservoir, whether existing or planned, in which water may be stored for useful purposes.

Treatment works - Any devices and systems which are used in the storage, treatment, recycling, and reclamation of waste or which are necessary to recycle or reuse water at the most economical cost over the estimated life of the works, including intercepting sewers, outfall sewers, pumping, power, and other equipment and their appurtenances; extensions, improvements, remodeling, additions, and alterations thereof; elements essential to provide a reliable recycled supply such as standby treatment units and clear well facilities; and any works, including sites therefor and acquisition of the land that will be a part of, or used in connection with, the treatment process or is used for ultimate disposal of residues resulting from such treatment; and any plant, disposal field, lagoon, canal, incinerator, area devoted to sanitary landfills, or other facilities installed for the purpose of treating, neutralizing or stabilizing waste; or facilities to provide for the collection, control and disposal of waste.

Waste - The same meaning as provided by the Texas Water Code, §26.001.

Wastewater client - Any person acting within his authority who acquires or seeks to acquire by purchase, transfer, or lease all or any part of a wastewater facility owned by the state in a particular regional wastewater treatment facility.

Wastewater facility - The whole or any definable part or portion of a regional wastewater treatment and/or collection facility, whether existing or planned, in which the board has an interest.

Water client - Any person acting within his authority who acquires or seeks to acquire the right to use water from storage facilities owned by the state in a particular reservoir.

Water conservation plan - A report outlining the methods and means by which water conservation may be achieved.

Water conservation program - A comprehensive description and schedule of the methods and means to implement and enforce a water conservation plan.

Water development bonds - Bonds authorized by the Texas Constitution, Article III, §49-c, and §49-d, and bonds dedicated to use for the purposes under Texas Constitution, Article III, §49-d-2.

Water development program - Procedures for the investment of development funds by the purchase of bonds or other obligations issued by a political subdivision to finance a project as authorized by the Texas Constitution, Article III, Sections 49-c and 49-d.

Water facility - The whole or any definable part or portion of a regional water treatment and distribution facility, whether existing or planned, in which the board has an interest.

Water Loan Assistance Program - The procedure for the investment of water loan assistance funds by contracts to purchase bonds issued by a political subdivision to finance a project as authorized by the Texas Water Code, Chapter 15, Subchapter C.

Water quality enhancement bonds - The Texas water development bonds authorized by the Texas Constitution, Article III, §49-d-1, and bonds dedicated to use for the purposes of that section by the Texas Constitution, Article III, §49-d-2.

Water quality enhancement funds - The proceeds from the sale of Texas water development bonds issued under the authority of the Texas Constitution, Article III, §49-d-1, and proceeds from bonds dedicated to use for the purposes of that section by the Texas Water Constitution, Article III, §49-d-2.

Water quality enhancement loan - The purchase by the state of the bonds or other obligations of a political subdivision with water quality enhancement funds.

Water Quality Enhancement Program - The procedure for the investment of water quality enhancement funds by the purchase of bonds issued by a political subdivision to finance treatment works for the purposes authorized by the Texas Constitution, Article III, §49-d-1.

Water treatment client - Any person acting within his authority who acquires or seeks to acquire by purchase, transfer,

or lease, all or any part of the water treatment and distributic facilities owned by the state in a particular regional water treatment facility.

Water, Wastewater, and Storage Facilities Acquisition Program - The procedure for investment of development funds in a project by the purchase or acquisition of an interest in such project as authorized by the Texas Constitution, Article III, §4 and §49-d-2, and pursuant to the board rules.

§363.3. Definition of Terms for Flood Control Program. Th following words and terms, when used in this chapter, in relatic to the Flood Control Program, shall have the following meanings, unless the context clearly indicates otherwise.

Financial assistance - Any loan of flood control funds made a political subdivision for structural or nonstructural flood control measures through the purchase of bonds or other obligati of the political subdivision.

Flood control funds - The proceeds from the sale of Texas water development bonds issued under the authority of the Texas Constitution, Article III, §49d-2, and reserved for flood contro purposes.

Floodplain - Land subject to inundation by the 100-year-frequency flood.

Floodplain management plan - A comprehensive plan for flood control within a watershed, based on analyses of alternative nonstructural and structural means of reducing flood hazards, including assessments of costs, benefits, and environmental effe and may include preliminary design of structural flood control projects.

Nonstructural flood control - Includes such measures as

(A) acquisition of floodplain land for use as public open space;
(B) acquisition and removal of buildings located in a floodplain;
(C) relocation of residences or buildings removed fr floodplain; and
(D) zoning and other ordinance controlled use of floodplains.

Structural flood control - Includes such measures as construction of stormwater retention basins, enlargement and/or realignment of stream channels, and modification or reconstruct of bridges.

100-year flood - The peak flood discharge of a stream, bas upon statistical data, which would have a 1.0% chance of occurr in any given year.

§363.4. Suspension of rules. The board may suspend or wa a rule, in whole or in part, upon the showing of good cause or when, at the discretion of the board, the particular facts or circumstances render such waiver of the rule appropriate in a g instance.

POLICY DECLARATIONS
Texas Administrative Code Sections 363.31-363.38

The following rules are promulgated under the authority of Section 6.101, Texas Water Code.

§363.31. General Policies.

(a) In accordance with constitutional and statutory directives, the goal of the Texas Water Development Board is to provide financing, where appropriate and in the public interest; to implement projects and programs necessary to further orderly development and management of the states water resources; to maintain and enhance, where feasible, the quality of this resource; to reduce flood damages; and to promote measures designed to achieve conservation of the waters of the state in accordance with the intent of the Texas legislature and the people of Texas as expressed through enactment and voter approval of House Joint Resolution 6 and House Bill 2, 69th Legislature, 1985. The programs implemented by these sections will continue to assist eligible political subdivisions of the state which are unable to implement projects without state assistance (commonly referred to as hardship loans), as the water development fund has done in the past, and will further the orderly development of regional water and wastewater facilities and flood control measures through loans and through state participation, where applicable, in water and wastewater projects.

(b) In accordance with the provisions of House Bill 2, 69th Legislature, 1985, the board will encourage local political subdivisions of the state to implement regional water supply and wastewater treatment facilities, consistent with the Texas Water Plan and the State Water Quality Management Plan, and flood management measures, where such facilities and measures are appropriate, more efficient and more cost-effective, and/or environmentally sound. Amendments to the Texas Constitution approved by the voters on November 5, 1985 authorize a substantial increase in the amount of state bonds which may be issued by the board to provide funds for state participation in projects, and also expand the types of water-related projects and measures eligible for state participation. Orderly planning and implementation of regional facilities will hopefully mitigate existing problems which have resulted from proliferation of multiple, commonly inefficient, and generally more costly water and wastewater systems in urban areas of the state, and may also prevent such problems from occurring in rapidly developing areas.

(c) Whenever possible, where state financial assistance is necessary to implement a project, it is the board's preference that the application be filed under provisions of one of the several programs in which the board purchases bonds of local political subdivisions rather than under the board's water, wastewater, or storage facilities acquisition program. The board will require participating political subdivisions to use their own financial resources to the maximum extent possible, and to exhaust all other reasonable means of financing before seeking state participation. However, where political subdivisions are seeking to implement regional water supply and wastewater treatment facilities, regional or area-wide flood control measures, facilities to convert from the use of groundwater to the use of surface water in areas where continued reliance upon ground water is causing, or will cause, undesirable environmental and social problems, the board will consider state financial assistance in accordance with legislative intent expressed in House Bill 2, 69th Legislature, 1985.

(d) It is the policy of the board to promote the conservation of water in the state by requiring implementation of those practices, techniques, and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses.

§363.32. Eligible Facilities.

(a) It is the policy of the board to finance water supply projects involving reservoirs, wholesale storage and distribution systems, wells, and filtration and water treatment plants, including any system necessary to transport water from storage to points of retail distribution or from source or storage to filtration and treatment plants, or points of retail distribution.

(b) It is the policy of the board to finance wastewater projects involving collection systems and treatment facilities. Only hardship loans will be made for facilities not determined to be regional in scope. Furthermore, hardship loans will not be made for collection systems to serve substantially undeveloped areas.

(c) It is the policy of the board not to finance retail water distribution systems or routine internal drainage facilities for cities, counties, towns, districts, or any other political subdivisions.

(d) It is the policy of the board to provide financing for the development of floodplain management plans and for structural and nonstructural flood control measures. Flood control measures funded by the board will, wherever possible and appropriate, constitute an element or

elements of a comprehensive, area-wide plan for flood control or flood management. The board recognizes the magnitude of flooding problems in the state and the limited funds available to the board to assist political subdivisions in correcting these problems. It is therefore the policy of the board to place a priority on flood control measures that are integral parts of regional, watershed plans that include alleviation of existing flooding problems within already developed areas of watersheds.

(e) Applicants for flood control loans shall be located within an area in which National Flood Insurance is available at the time of application and throughout the life of the board's financial assistance.

(f) In the absence of any legislative appropriation for operation and maintenance expenses or other sources of revenue specifically for that purpose, the board will not bear any portion of the operation and maintenance expenses for state-owned interest in any water, wastewater or storage facilities acquisition project, and any state interest is acquired without the assumption of any obligation relating to future operation and maintenance expenses. This section is subject to the provisions of the Texas Water Code, §16.1341.

§363.33. Requirements as to Maturity. It is the policy of the board to structure financial assistance to applicants such that the board can maximize the financial resources available to the board. The maturities on loan repayments and projected schedules for the purchase of the state's interest in a state acquisition project shall be structured in such a manner so as to encourage maximum utilization of any other public or private sources of funding.

§363.34. Financing Requirements Beyond Current Board Capability. If the board does not have sufficient financial resources available to meet the needs of all applicants for financial assistance, the development fund manager will prepare a complete report on such applications as if funds were available, and will recommend to the board that each particular project be included in, or excluded from, the board's biennial budget request to the legislative budget board and to the presiding officers of each house of the legislature and to the governor. The list of such projects included in the board's biennial budget request shall include: relevant information on each project, a determination as to whether or not the project is consistent with the amended Texas Water Plan and/or the current State Water Quality Management Plan, local and regional plans, the potential environmental impacts of the project, and recommendations concerning the terms under which financial assistance should be made as well as projected funds that would be required during each ensuing biennium to complete the project.

§363.35. Permits. The board will require an applicant seeking assistance under the water, wastewater, and storage facilities acquisition program to obtain appropriate state permits before the board will extend a commitment for financial assistance. The board may make commitments for loan-assisted projects prior to all state permits being received, but will not deliver financial assistance funds under any of the authorized financial programs until an applicant for financial assistance has obtained all appropriate state permits.

§363.36. Participation. The legislature is empowered to place biennial limitations on the water, wastewater and storage facilities acquisition program in order to control potential draws on the general revenue fund, to increase the number of facilities constructed, and to minimize financial risks to the state. In furtherance of these legislative objectives, and in order to assist the board, in making the required statutory finding that it is reasonable to expect that the state will recover its investment in the facility, it is the policy of the board to require that at the time an application involving state participation is considered by the board, a projected schedule for purchase of the state's interest in the project be developed and presented to the board, unless to do so is inappropriate. Priority consideration will be given to applications involving other sources of funding, since one of the principal purposes of the fund is to encourage optimum development of the state's water resources and implementation of regional water supply, wastewater treatment, and flood control facilities, where appropriate.

§363.37. Ancillary Recreational Facilities. The board will consider applications by participating political subdivisions for assistance toward the purchase of land required for development of needed recreational facilities associated with a project. The primary emphasis in considering the recreational purpose of a project shall be the optimum public use and enjoyment of such project and recoupment of the state's investment in the development of the project. It is expressly provided that such planned facilities:

(1) shall be an integral part of the proposed project;
(2) shall be in an area where needed and not otherwise available to the general public;
(3) shall be operated so that any recreational use of water in the project will be in accordance with the commission's permit for same;
(4) shall have been submitted to the Texas Parks and Wildlife Department and/or other agencies having responsibility and jurisdiction in the premises for review and comment as to:
    (A) the facilities for which there is the greatest need; and

(B) adherence and consistency with any existing regional out door recreational plan and Texas Outdoor Recreation Plan;

(6) be supported by a system of fees and charges, where practicable, for use of recreational areas to ensure proper operation and maintenance of such facilities and recoupment of the state's investment therein.

§363.38 Lending Rate.

(a) Policy - It is the policy of the board through the implementation of the lending rate to serve the communities of the state by passing on the credit of the state to political subdivisions in the form of loans with interest rates which reflect the state's cost of funds. The board will establish rate scales for each maturity of loans to political subdivisions. In establishing the lending rate scales, the board will take into account the true interest cost of the money to the state including issuance costs and the risks associated with the operation of the financial assistance program. The board will continuously review the lending rate scale, in light of current market conditions, and should there be substantial changes in market conditions, alter the scale if changes are necessary.

(b) Implementation - The rate scale applied may be determined by the type of project and/or the type of pledge received. The projects will be divided into three groups: the first group will include water development projects; the second includes water quality enhancement projects; and the third includes flood control projects. Within these groups, scales may be categorized by the type of pledge received. The board reserves the right to determine the lending rate scale applied and maturity schedule for each loan.

(c) Special Projects - The board may, from time to time, be approached by political subdivisions with proposed projects which may require special financing by the board. Because of the special and unusual characteristics of these projects, separate lending rates for these projects may be established to fit the special circumstance that may be applicable to these projects.

(d) 270 Day Commitment - The board from time to time finds itself in a position of investing idle bond proceeds at a rate substantially below the cost of bond proceeds. For this reason, financial assistance commitments will remain in effect for no longer than 270 days; however, the applicant may request that the board extend this commitment beyond the original 270 days. If the board extends the loan commitment beyond the 270 days, it reserves the right to assess a fee for these extensions.

Each fee will be established on a case-by-case basis after board consideration and approval.

APPLICATIONS TO THE BOARD
Texas Administrative Code Sections 363.52-363.60

The following rules are promulgated under the authority of Section 6.101, Texas Water Code.

§363.52. Required General Information.

(a) An applicant seeking financial assistance should make an appointment with the staff of the development fund. At a minimum, the preapplication conference should be attended by a member of the governing body of the political subdivision, the entity's engineer, and financial advisor. The primary purpose of the meeting is to establish basic eligibility of the political subdivision for financial assistance. The determination of eligibility will, in most cases, be made at this meeting.

(b) Forty copies of an application shall be filed with the board. The following information is required on all applications to the board for financial assistance:

(1) legal name(s) of applicant and authority of law under which created;

(2) name, title and address of official correspondent or representative for applicant and each participating political subdivision;

(3) names and titles, of principal officers, including the managing official of applicant and each participating political subdivisions;

(4) name and address of project engineer; or if engineering will be performed by a federal agency, the name and address of the office of the federal agency performing such work;

(5) name and address of legal counsel for applicant. In an application for financial assistance which envisions the purchase of applicant's bonds by the board, the name and address of bond counsel is also required (if other than legal counsel) and the name and address of financial advisor or consultant;

(6) brief description of project including but, not limited to, the following:

(A) location;

(B) a comprehensive statement clearly demonstrating the project need and timing of need in sufficient detail to support and justify the project;

(C) the total estimated cost and allocation of cost to each purpose such as water supply, recreation, flood control, transportation, or sewage treatment;

(D) if a dam and reservoir project is proposed, the estimated firm annual yield and proposed reservoir capacities for conservation storage,

sediment storage, flood control storage, and storage for other purposes (specify each purpose);

(E) proposed allocation and source of project cost to each participating subdivision, state, and federal agency;

(F) proposed division of the total ownership interest in the project for each participating subdivision (and the board, if acquisition is contemplated); and

(G) source of project's water supply;

(7) if a federal project, the name of the federal agency and the extent to which federal planning has progressed. If a federal grant is involved, the amount of the total federal grant and the status of the application for the federal grant;

(8) with respect to each participating political subdivision, the legal procedures, such as confirmation elections, annexation proceedings and contract and bond election, required to enable the applicant to assume its obligations with respect to the project, including the stage to which any such procedures have progressed;

(9) information on the basis of which the board can determine whether:

(A) the state will recover its investment;

(B) the cost of such facilities to be acquired exceeds current financing abilities of the area involved; and

(C) whether such facilities can be otherwise financed without state participation;

(10) status of any proceedings to obtain a permit or other authorization from the commission or any other state of federal agency;

(11) if the application is for a water, wastewater or storage facilities acquisition project, the following additional material:

(A) information regarding the inability of the applicant to finance development without state participation;

(B) estimated time and means for the recovery of the board's investment in the project from revenues, repurchase obligations of participating political subdivisions, or both; and

(C) evidence that the proposed facilities are consistent with the objectives of the state water plan and/or the state water quality management plan;

(12) required general information regarding any existing water conservation program, including but not limited to the following:

(A) education and information programs;
(B) plumbing code standards for water conservation in new construction;
(C) retrofit programs to improve water use efficiency in existing buildings;
(D) conservation-oriented water rate structures;
(E) universal metering and meter repair and replacement;
(F) leak detection and repair;
(G) drought contingency plans;
(H) ordinances and emergency procedures;
(I) water recycling and reuse; and
(J) water conserving landscaping;

(13) if an exemption from the water conservation program is requested under the Texas Water Code, Sections 15.106(c) or 17.135(c), information by which the board can determine whether:
(A) an emergency exists;
(B) the amount of financial assistance requested is $500,000 or less; or
(C) submission of a program is not necessary to facilitate water conservation.

§363.53. Required Environmental Data. The application shall address the environmental effects of the project in accordance with the requirements of §341.21-341.26 of this title (relating to Environmental Impact Statements) and §341.41-341.43 of this title (relating to Guidelines on the Preparation of Environmental, Social, and Economic Impact Statements). Prior to taking an application to the board, the executive administrator shall determine if a complete environmental impact statement should be prepared, or if an environmental assessment following §341.42-341.43 of this title (relating to Guidelines for the Preparation of Environmental, Social, and Economic Impact Statements) will be sufficient. Normally, environmental impact statements will be required for major facilities, such as reservoirs and regional flood control projects. After reviewing the submitted environmental information, the executive administrator shall determine if sufficient environmental data have been supplied to forward the application to the board. The executive administrator shall recommend to the board whether the proposed project is environmentally sound, based on the criteria and guidelines of the board and full consideration of the views and comments of other agencies and persons.

§363.54. Required Fiscal Data.

(a) The applicant shall submit a statement of the project engineer's most current estimate of project cost itemized as to major facilities or items including land and right-of-way costs, fees of engineers, all legal fees, fees of financial advisors and/or consultants, contingencies, and interest during construction.

(b) The following information is to be furnished when the applicant proposes to sell bonds to finance the project, whether the purchasers are to be the board or others tha the board:
(1) citation of statutory authority for issuance;
(2) type of bonds (i.e., general obligation, revenue, o combination). If revenues are to be pledged, state the source and nature of such revenue;
(3) amount of the issue;
(4) full name of issue(s);
(5) approximate date of issue(s);
(6) proposed maturities; and
(7) details of option for prior payments.

(c) The applicant shall submit the amount and source of any funds to be expended on the project.

(d) If applicant is authorized by law to levy and collect ad valorem taxes, give the information in paragraphs (1) an (2) of this subsection.
(1) If such right and power have been exercised, give the following information for each of the five preceding years:
(A) assessed valuation of taxable property;
(B) ratio of assessed valuation to actual market value in a specified year;
(C) maximum tax rate permitted by law per $100 of assessed valuation;
(D) aggregate rate of all taxes levied and aggregate amount in dollars of taxes collected;
(E) total amount in dollars of taxes collected; a
(F) distribution of tax rate as between interest and sinking fund and other purposes.
(2) If applicant is newly created, or if it has never exercised its taxing power, give the following information:
(A) assessed valuation of taxable property if valuations have been established, and if not the estimated total amount of the assessed valuation of taxable property. Indicate whether the figure represents actual valuati or an estimate; and
(B) maximum tax rate permitted by law per $100 c assessed valuation.

(e) The applicant shall give details of any limitation governing amount of bonded or general obligation debt which applicant may incur.

(f) If applicant has bonds outstanding which are payable wholly or in part from ad valorem taxes, the followin information shall be submitted:
(1) a complete description of each such issue of bor including title, date, interest rate, maturitie amount outstanding, and prepayment options;

(2) consolidated schedule of future requirements of principal and interest extended so as to reflect total annual requirements; and
(3) direct and overlapping debt statement.

(g) If financing of project will involve sale of bonds or other securities payable wholly or in part from ad valorem taxes, the following information shall be submitted:
(1) schedule of proposed future maturities of principal and interest of proposed bonds plus total maturities of any outstanding bonds from subsection (f) of this section; and
(2) rate of interest assumed in computing future interest maturities on proposed bonds.

(h) If project for which state participation is desired is for purpose of extending, enlarging or improving an existing system or facility, the following shall be submitted for each of the five preceding years to the extent available:
(1) comparative operating statement;
(2) schedule of water or sewer rates or service charges; and
(3) number of customers or patrons of system.

(i) The applicant shall provide a schedule of proposed rates required for financing the project under consideration, if different from subsection (h)(2) of this section.

(j) If applicant has bonds outstanding which are payable either wholly or in part from net revenues of a system or facility in connection with which the current project is planned, the following information shall be submitted:
(1) a complete description of each such issues of bonds, including title, date, interest rate, maturities, amount outstanding, and prepayment options; and
(2) consolidated schedule of future requirements of principal and interest extended so as to reflect total annual requirements.

(k) If financing of the project will require the sale of bonds or other securities payable either wholly or in part from net revenues of one or more facilities or systems, the following information shall be submitted:
(1) schedule of proposed future bonds plus total maturities of any outstanding bonds referred to in subsection (j)(2) of this section; and
(2) rate of interest assumed in computing future interest requirements on proposed bonds.

(l) The applicant shall provide a statement as to whether or not there has been a default in the payment of items of matured principal or interest and if so, give details.

(m) The applicant shall provide an annual audit of financial report prepared by an independent auditor as of the close

of the preceding fiscal year. (Not required if applicant has no operating history).

(n) Where the project envisions the sale of revenue bonds, a schedule of the project engineer's estimate of future income and expense, showing the estimated amount of net revenue to accrue in each year during the life of any bonds to be issued.

§363.55. Required Engineering Feasibility Data for Water Supply Projects. The applicant shall submit for approval four copies of an engineering feasibility report. Prior to submission of the report in the application, the applicant's engineer shall have met with the board's engineering staff to discuss the scope of the feasibility report. The report as presented in the application shall include:

(1) legal name of applicant and authority of law under which it was created and operates;
(2) name, address, and telephone number of project engineer;
(3) the location and description of the proposed project. As a minimum, this requirement may be met by showing location on a Texas Department of Highways and Public Transportation Planning Survey Division map (1/2 size);
(4) if water development and/or water facilities acquisition project, the need for the project, including proposed purposes for which water will be stored or used and places of use for the water and projections of future estimated needs, uses and places of use for the water;
(5) a description of facilities to be acquired or replaced;
(6) proposed improvements or enlargements of existing facilities;
(7) the basis of the design, including a detailed scope of operations for the project. Where extensions are proposed to an existing project, include an engineering functional evaluation of the existing facilities;
(8) the relationship of the project to other existing and proposed facilities in meeting long-range water quantity or water quality needs;
(9) the feasibility of the project, including description of all alternatives considered, evaluation of each alternative, and reasons for the selection of the proposed project. The report shall demonstrate that the proposed project represents the best alternative for water supply considering the economic, social, financial, environmental, and engineering aspects involved;

(10) if a dam and reservoir project, the proposed conservation, sediment, flood control, and other storage capacities; corresponding areas and elevations; the expected firm annual yield; expected quality of water impounded; and existing water rights and purposes of use affected by the project;

(11) total estimated cost and allocation of cost of each of the project purposes. Sufficient detail should be provided to support the estimated costs;

(12) when a public water supply project is proposed, consideration of the minimum requirements of the Texas Department of Health relative to quantity and storage;

(13) when a dam and reservoir is proposed:

(A) an area map on which the estimated acreage to be acquired and the proposed project take-line encompassing such acreage are shown. The area shall be delineated on a topographic quad sheet or equivalent such that areas can be easily determined;

(B) a detailed gross appraisal report, including a land-use and improvement summary for all proposed land purchases, prepared by a professional land appraiser. An additional land appraisal report may be required at the discretion of the board. The land values so determined shall be used as a basis for feasibility calculations. The estimated total land acquisition cost should include a provision for projected appraisal, title search, legal, and other associated costs;

(C) description of all improvements (including roads, cemeteries, railroads, and public utilities) in the project area that must be relocated or protected;

(D) letters, agreements, or other evidence from owners and/or responsible entities on improvements to be relocated or protected, stating their position on acceptable means for such relocation or protection and the estimated cost therefore; and

(E) the proposed recreational development and management plan, including anticipated buildup in demand, initial facilities to be provided, and proposed area to be dedicated to recreational use;

(14) a geologic evaluation of the site, accompanied by drilling logs showing sufficient density of test holes and sufficient lithologic details to indicate that a suitable development site has been selected;

(15) description and evaluation of the relationship between proposed surface water development and ground water resources, or the converse, and the effects of each upon the other;
(16) if a ground water development, complete analyses of the hydrologic and hydraulic characteristics of the aquifer including, if necessary, subsurface data obtained from drilling test holes and test pumping;
(17) the engineering report, which shall be signed and sealed by a professional engineer registered in the state of Texas in accordance with the Texas Engineering Practice Act, Texas Civil Statutes, Article 3271a, and which report shall not be more than six months old. If the report is more than six months old, it shall be accompanied by a statement from the engineer that he has reviewed the project as originally prepared and finds that it is substantially current and correct in view of all existing circumstances. In such event, a detailed updated cost estimate shall be provided; and
(18) additional information or data which the executive administrator or development fund manager may require, including additional subsurface explorations prior to the submission of the application or as a condition precedent to final approval.

§363.56. Required Engineering Feasibility Data for Flood Control Projects. The applicant shall submit for approval four copies of an engineering feasibility report. Prior to submission of the report, the applicant's engineer shall have met with the engineering staff of the board to discuss the scope of the feasibility report. In the case of flood control projects, the report as presented in the application shall include the following information:

(1) If the loan is for the purpose of developing a floodplain management plan, the following information shall be submitted:
  (A) a statement indicating the authority of the applicant to prepare a comprehensive floodplain management plan, and the applicant's legal authority, if any, to enforce such a plan;
  (B) location and background history of the watershed or watersheds in the area. Maps and drawings of watersheds should be included. Information should be provided for the entire watershed drained by a river, creek, bayou or other channels and their tributaries within the planning area.
(2) If the proposed loan is for structural or nonstructural flood control, the following information will be required:

(A) the name of the political subdivision and its principal officers;
(B) a citation of the law under which the political subdivision operates and was created;
(C) a description of the flood control measures for which the financial assistance will be used;
(D) the estimated total cost of the measures;
(E) the amount of state financial assistance requested;
(F) the method for obtaining the financial assistance, whether by purchase of bonds or purchase of other obligations of the political subdivision;
(G) the plan for repaying the financial assistance;
(H) the availability of revenue to the political subdivision, from all sources, for the ultimate repayment of the cost of the project, including interest;
(I) the capacity of the watershed to accommodate stormwater runoff;
(J) the impact of the project on watershed capacity along the entire watershed and the degree to which that capacity was considered in planning the project;
(K) whether the project will increase or decrease the volume or rate of stormwater runoff into any channel in the watershed;
(L) the effect of the project on surface water elevations within the watershed and any downstream watershed;
(M) the relationship of the project to any floodplain management plan for the watershed;
(N) whether adequate consideration was given to the effects of the project with regard to erosion and sediment control;
(O) the feasibility of the project, including a description of all alternatives considered, evaluation of each alternative, and reasons for the selection of the proposed project. Nonstructural alternatives should be evaluated for their feasibility; and
(P) additional information on or data which the executive administrator or development fund manager may require.

§363.57. Required Engineering Feasibility Data for Wastewater Projects. The applicant shall submit for approval four copies of an engineering feasibility report. Prior to submission of the report in the application, the applicant's engineer shall have met with the board's engineering staff to discuss the scope of the feasibility report. The report, as presented in the application,

shall include the information regarding design criteria for sewerage systems listed under §317.1(b) of this title (relating to General Provisions) and the following general information:

(1) legal name of applicant;
(2) name and address of the project engineer;
(3) type of treatment plant being proposed. The selection of a treatment process must take into account the cost-effectiveness and environmental compatibility of various processes; and
(4) cost breakdown. A detailed cost estimate for all work shall be submitted, including operation and maintenance.

§363.58. Required Legal Data.

(a) The applicant shall submit a statement setting forth the existing or future need for the project, the probable benefits to the area to be served by the project, the steps previously taken or currently being taken to finance the project without state assistance, and the reasons why other financing is not available to defray the entire project cost.

(b) If a bond election is required by law to authorize the issuance of bonds to finance the project, such election should be held prior to consideration of the application by the board. Applicant shall provide the development fund manager with the election date and election results as to each proposition submitted.

(c) The applicant shall submit a certified copy of a resolution of the governing body of each participating political subdivision requesting financial assistance from the board, authorizing the submission of the application, designating the official representative for executing the application and appearance before the board, and containing a finding that the applicant cannot reasonably finance the project without assistance from the board in the amount requested. Additional evidence on inability to finance the project without state investment may also be required by the board.

(d) The applicant shall submit a copy of any actual or proposed contract under which any portion of the applicant's water supply is purchased or transported or under which sewer service is provided. Before a loan is closed, a certified copy of such contract shall be required.

(e) If financing of the project will require the sale of bonds to the board payable either wholly or in part from revenues of contracts with others, the applicant shall submit a copy of any actual or proposed contracts under which applicant's gross income is expected to accrue. Before a loan is closed, an applicant shall submit

certified copies of such contracts to the development fund manager.

(f) The applicant shall submit a pro forma draft of an ordinance, resolution, or similar instrument to be adopted by the governing body authorizing the issuance of each of the bond issues described in §363.54(g) and §363.54(k) of this title (relating to Required Fiscal Data). When application for financial assistance which envisions the purchase of applicant's bonds by the board is made, such ordinance, resolution, or similar instrument shall contain, in addition to the usual provisions, sections providing:

(1) that a construction fund shall be created which shall be separate from all other funds of the political subdivision. The construction fund shall be established at an official depository of the political subdivision and all funds in the construction fund shall be secured in the manner provided by law for the security of county funds or city funds, as appropriate. If the political subdivision is not required by law to maintain its funds in an official depository, then it shall designate a depository with the approval of the development fund manager and shall maintain the construction fund in such depository and require that funds therein be secured in the manner provided by law for county funds. All proceeds from the sale of bonds to the board and all other proceeds acquired by the political subdivision to construct or acquire the project shall be placed in the construction fund. All proceeds in the construction fund shall be used for the sole purpose of constructing the project as approved by the board except as otherwise stated in these sections or approved by the board;

(2) that a final accounting be made to the board of the total cost of the project upon its completion. Such resolution or ordinance shall also provide that if the project be finally completed at a total cost less than the amount of available funds for constructing the project, or if the development fund manager disapproves construction of any portion of the project as not being in accordance with the plans and specifications, the participating political subdivision shall immediately, after filing the final accounting, return to the board the amount of any such excess and/or the cost as determined by the development fund manager relating to the parts of the project not constructed in accordance with the plans and specifications, to the nearest multiple of $1,000 or $5,000, depending upon the denomination of the bonds being sold. Thereupon, the board shall

cancel and deliver to the participating political subdivision a like amount of the bonds of the participating political subdivision held by the board in inverse numerical order. Any remaining funds will be deposited in the interest and sinking fund for bonds purchased by the board. Unless otherwise stated in the loan commitment, in determining the amount of available funds for constructing the project, the political subdivision shall account for all monies in the construction fund, including all loan funds extended by the board, all other funds available from the project as described in the project engineer's sufficiency of funds statement required for closing the board's loan and all interest earned by the political subdivision on money in the construction fund. This requirement shall not be interpreted as prohibiting the board from enforcing such other rights as it may have under law;

(3) that an annual audit of the participating political subdivision, prepared by a certified public accountant or licensed public accountant be provided to the development fund manager;

(4) that the participating political subdivision shall maintain adequate insurance coverage on the project in an amount adequate to protect the board's interest;

(5) that as built plans be provided to the board; and

(6) that the issuer will implement any water conservation program required by the board until all financial obligations to the State have been discharged.

(7) that the issuer covenants to abide by the board's rules and relevant state statutes, including the Texas Water Code, Chapters 15, 16, and 17.

(g) The applicant shall submit an affidavit executed by the official representative of the participating political subdivision stating that the facts contained in the application are true and correct to his best knowledge and belief.

(h) The applicant shall submit a copy of any existing proposed construction contract.

(1) All proposed contracts shall have provisions assuring compliance with the board's rules and all relevant statutes, including the Texas Water Code, Chapters 15, 16, and 17, as appropriate. Further, the contract shall provide that failure to construct the project according to the plans and specifications approved by the executive administrator, development fund manager, board, and/or the commission, as is appropriate, for any and all

modifications, amendments, or changes to such engineering plans, regardless of the nature, character, or extent of such changes; failure to construct the project in accordance with sound engineering principles; or failure to comply with any term or terms of the construction contract, shall be considered by the development fund manager as grounds for refusal to give a certificate of final approval for any construction contract. Such contract shall also require the contractor to observe all rules of the board. The provisions of the contract shall constitute an agreement for the benefit of the board under principles applicable to third party beneficiary contracts; however, such provisions are not intended nor shall they be in such form as to constitute an agreement for the benefit of any other third party or parties other than the board.

(2) The participating political subdivisions shall be represented by a registered professional engineer who shall inspect the project at each phase of construction to assure construction in substantial compliance with the plans and specifications and in accordance with sound engineering principles and the terms and provisions of the construction contracts.

(3) The applicant shall submit such other provisions as may be deemed necessary to provide the board and the participating political subdivision adequate control to ensure that materials furnished or work performed conform with the provisions of the construction contracts.

(i) The applicant shall submit copies of any proposed or existing contracts for consultant services necessary for construction of the proposed project and included as part of the total cost of the project.

(j) The applicant shall submit a certification by the designated representative of the participating political subdivision in a form acceptable to the board which warrants compliance by the participating political subdivision with all representations in the application, all laws of the State of Texas and all rules and published policies of the board.

(k) If bonds to be sold to the board are revenue bonds secured by a subordinate lien, then a copy of the authorizing instrument of the governing body in the issuance of the prior lien bonds shall be furnished.

(l) The applicant shall submit a copy of any proposed or existing lease or other agreement transferring interests in any land acquired for the project.

(m) The applicant shall submit other information, plans, and specifications requested by the board or the executive

administrator which are reasonably necessary for an adequate understanding of the project.

§363.59. Required Water Conservation Plan.

(a) The applicant, if not eligible for an exemption, shall submit either with its application or separately under subsection (b) of this section two copies of a water conservation plan for approval. Before the application is filed, all applicants or their representatives shall discuss the scope and content of the plan with members of the board's staff who are responsible for reviewing the water conservation plan. At the applicant's request, the executive administrator may provide educational material and, to the extent staff personnel are available, may provide technical assistance in developing a comprehensive water conservation plan that is designed to meet existing and anticipated local needs and conditions. The executive administrator shall review all water conservation plans submitted as part of an application for financial assistance for a project, shall determine if the plans are adequate, and shall present information to the Board on the water conservation plan when the application is considered by the board.

(b) An applicant may elect to submit the required water conservation plan after the board approves its application for assistance but before any funds are released. In such case, the applicant shall submit the conservation plan to the executive administrator for review. The executive administrator shall make a preliminary determination as to whether the plan is adequate, and shall submit the plan to the board for consideration. The board will approve, disapprove, or approve with modifications the applicant's water conservation plan during an open meeting. The board may revise the amount and conditions of its financial commitment after considering the water conservation plan.

(c) The long-term water conservation plan required under subsections (a) or (b) of this section shall be consistent with the guidelines for water conservation planning available from the executive administrator. The plan shall serve as the basis for developing and implementing a conservation program. At a minimum, the plan shall consider, and as appropriate include, each of the elements in §363.52(b)(12) of this title (relating to Required General Information). Reasons for not including any of the elements stated in §363.52(b)(12) of this title (relating to Required General Information) shall be clearly stated. The plan shall effectively address the following:

(1) need for the goals of a water conservation program;

(2) methods to reduce water consumption;

(3) methods to reduce the loss or waste of water;
(4) methods to improve efficiency in use of water; and
(5) methods to increase the recycling and reuse of water.

(d) The board may not require an applicant to provide a water conservation plan if the board determines an emergency exists, the amount of financial assistance to be provided is $500,000 or less, or implementation of a water conservation program is not reasonably necessary to facilitate water conservation.

(1) An emergency exists when:

(A) a public water system or wastewater system has already failed, or is in a condition which poses an imminent threat of failure, causing the health and safety of the citizens served to be endangered; (B) sudden, unforeseen demands are placed on a water system or wastewater system (i.e., because of military operations or emergency population relocation); (C) a disaster has been declared by the governor or president; or (D) the Governor's Division of Emergency Management of the Texas Department of Public Safety has determined that an emergency exists.

(2) The board shall review an application for which an emergency is determined to exist six months after the board commits to financial assistance, and also at the time of any extensions of the loan commitment. If the board finds that the emergency no longer exists, it may then require submission, within six months, of a water conservation plan satisfactory to the board before making any further disbursements on the commitments.

(3) Submission of a plan is not necessary to facilitate water conservation if the applicant already has a program in effect that meets the requirements of subsection (a) of this section and of §363.85 of this title (relating to Water Conservation Program Prerequisites).

§363.60. Return of Insufficient Application. The development fund manager shall return any application not in substantial compliance with these rules.

FORMAL ACTION BY THE BOARD
Texas Administrative Code Sections 363.71-363.72

The following rules are promulgated under the authority of Section 6.101, Texas Water Code.

§363.71. Board Consideration of Application. After all required instruments and data have been supplied and routine processing by the development fund manager is complete, the development fund manager shall submit the application to the board with comments concerning the best method of making financial assistance available. Upon a recommendation by the development fund manager that such application is complete and in order for board review, the application shall be scheduled on the agenda for board consideration not earlier than the second regularly scheduled board meeting following the development fund manager's certification of the sufficiency of the application. The applicant and other interested parties known to the board shall be notified of the time and place of such meeting. Evidence and arguments both for and against the granting of the application may be heard at such meeting.

§363.72. Action of the Board on Application. At the conclusion of the meeting to consider the project, the board may resolve to approve, disapprove, amend, or continue consideration of the application. If the board commits itself to participate in the project, such commitment for financial assistance shall expire 270 days after the board's action making the commitment, unless another time for expiration of the commitment is stated by the board or the period of time for expiration of the commitment is extended by the board. Any extension must be requested of the board by application filed with the development fund manager. Prior to referring such request to the board for consideration, the development fund manager may require the refiling of or updating of information contained in the original application. After such information is provided, the development fund manager will refer the request to the board along with his recommendation including whether a fee should be assessed the applicant for the extension, and amount of any such fee. Notice of the time and place of board consideration will be given to the applicant's designated representative.

PREREQUISITES TO RELEASE OF STATE FUNDS
Texas Administrative Code Sections 363.81-363.85

The following rules are promulgated under the authority of Section 6.101, Texas Water Code.

§363.81. Engineering Design Data Prerequisites

(a) An applicant seeking financial assistance for flood control, water and storage projects, pursuant to the Water Development Program, the Water, Wastewater and Storage Facilities Acquisition Program, the Water Loan Assistance Fund, or the Flood Control Program shall submit for development fund manager approval three copies of plans, specifications, and an engineering report on the project, which data shall be as detailed as would be required for submission to contractors bidding on the work, and which shall include, as appropriate:

(1) analyses of the quality and quantity of water to be used. If a dam and reservoir project is proposed, complete hydrology, flood routing, and storage capacities and corresponding elevations shall be provided;

(2) details of the hydraulic gradient calculations for pipelines and/or open channels based on maximum flow conditions;

(3) if a dam and reservoir project is involved:

(A) a topographic map of the dam site with contour intervals not exceeding five feet. A plan of the dam shall be superimposed on this map showing the location of spillways, outlet conduit, cut-off walls, etc. If an existing map is used, the source and date of such map shall be given;

(B) a geologic evaluation of the project area relating the local geologic setting to the regional geologic setting, accompanied by drilling logs showing sufficient density of test holes and sufficient lithologic details to verify that a suitable development site has been selected. A geologic profile of the dam site taken on the axis of the dam and a profile of the spillway along its axis shall be provided. The profile shall also show the location of the conduit, spillway, etc. Core drill holes shall be located and spaced to show geologic conditions at the site and shall be of sufficient depth to determine foundation conditions. Geologic cross sections of the reservoir area shall also be shown on a suitable map, including descriptions that represent the

local geologic conditions. Logs of the core drill holes and descriptions of the geologic sections shall be prepared by a professional geologist. All cores and bag samples recovered shall be available for examination, by the staff of the executive administrator, in proper condition and properly labeled. This evaluation should include a survey of any oil and gas wells to determine the possibility of contamination of the reservoir due to mineral wastes or to inadequately plugged wells;

(C) a soils report giving the recommended embankment slopes, berms, etc.; location of types of soil in the embankment (designate all borrow areas on construction plans related to the embankment zones of the dam); location of core trench and slope of core trench; stability analyses of the embankments; and seepage studies and recommended drainage systems for the embankment. Data from all soil tests performed should be included. This information shall also be shown and correctly plotted on the plans, on both plan view and elevation. A soils engineer assisted by a geologist, when necessary, shall be responsible for the planning and supervision of field studies;

(D) cross sections of the dam embankment and spillway sections at the maximum width section showing complete details and dimensions;

(E) complete details on hydraulic design of spillway structure. Unless otherwise justified and approved by the commission, the combined spillway capacity will be large enough to pass and properly still the probable maximum flood without overtopping the dam;

(4) cross-sections of all structures in sufficient number and detail to adequately define all features of the structure, and to permit complete hydraulic and structural analyses; and

(5) if a pipeline is proposed, the location shown by stationing and bearing. Profiles of proposed pipeline routes will also be required.

(b) An applicant seeking financial assistance for wastewater projects pursuant to the Water Quality Enhancement Program, the Water, Wastewater and Storage Acquisition Program and the Water Loan Assistance Program shall submit for approval to the executive administrator three copies of plans and specifications and an engineering design report, each of which shall conform to the requirements regarding design criteria for sewage systems in §317.1(b) of this title (relating to General

Provisions) and shall be as detailed as would be required for submission to contractors bidding on the work. The commission shall also review and approve all plans and specifications for wastewater treatment plants. In addition, the applicant shall submit for approval a draft copy of the construction contract bid document for each construction contract to be let and a draft operation and maintenance manual for the sewerage system. The final operation and maintenance manual shall be submitted for approval by the time construction is 90% complete. If a federal grant or loan is involved, the applicant may also be required to submit additional documents to satisfy the requirements of the Environmental Protection Agency's Construction Grant Program, Public Law 92-500, Title II.

(c) All applicants shall comply with the following.

(1) The plans and the engineer report shall be signed and sealed by a professional engineer registered in the State of Texas in accordance with the Texas Engineering Practice Act, Texas Civil Statutes, Article 3271a. The report shall not be dated more than six months prior to filing with the executive administrator or development fund manager.

(2) Maps prepared and submitted in conjunction with the project shall measure 22 or 24 inches by 36 inches outside, with a two-inch binding edge at the left; other margins shall be not less than 1/2-inch wide.

(3) Each engineering sheet, map, etc., shall bear a title in the lower right-hand corner showing the name and address of the owner, the county, the sheet number, total number of sheets, a description of details, and shall bear the seal and signature of a registered professional engineer.

(4) All specifications for materials and workmanship shall conform to such specifications as may be promulgated or recognized by the board.

(5) The applicant shall provide evidence that requirements and regulations of all state and federal agencies having jurisdiction have been met.

(d) The board, executive administrator, or development fund manager may require the submission of additional engineering data and information, if deemed necessary.

§363.82. Land and Right-of-Way Acquisition Procedures Prerequisites.

(a) A general outline of practices, procedures, and policies for land acquisition, including procedures for acquisition of rights-of-way, easements, and relocations, both voluntary and involuntary, shall be presented for the executive administrator or development fund manager's approval.

(b) The board may require procedures for control over project funds during construction to assure disbursement within approved appraisals and estimates or as may be required by judicial decree. In such event, the procedures will require certification to the executive administrator or development fund manager that individual acquisitions or relocations are within the appraised value or engineer's estimate prior to request for final release of funds for such acquisition or relocation. The procedures should make provision for submission to the executive administrator or development fund manager for approval of individual tract appraisal reports prior to contact with the owner of the tracts to be acquired.

(c) In the event of necessity for release of funds in excess of the appraised value or engineer's estimate, the board may require that requests be accompanied by a satisfactory explanation and justification of the participating political subdivision, together with evidence of the extent, if any, that such excess will affect the estimated total project cost.

(d) The applicant should include, within the general outline of the procedures, the qualifications of the personnel proposed for appraisal work, and the qualifications of land agents.

(e) The foregoing is not intended to be inclusive of all of the procedures which may be deemed necessary in the judgment of the board for an effective land acquisition and relocation program or which may be required for proper control of the disbursement of funds, but rather are intended as illustrative of the areas to which such procedures will have application. Provision for amendment of the initially approved procedures in the event of an anticipated increase in total estimated project costs will be required.

§363.83. Commission Permits and Resolution Prerequisite.

(a) Prior to the release of state funds for any financial assistance the applicant must obtain all required permits from the commission to appropriate, impound, divert, use or transport state waters, or to construct wastewater facilities as may be appropriate under the circumstances, or any other permit or approval that may be required by the commission.

(b) In addition to furnishing the board with certified copies of appropriate permits, the applicant shall furnish the board a resolution adopted by the commission certifying that an applicant proposing surface water development has the necessary water right authorizing it to appropriate and use the water the project will provide and/or that an applicant proposing underground water development has the right to use water that the project will provide.

(c) For a water or storage facilities acquisition project, the board may at its discretion become a coapplicant for a commission permit.

§363.84. Legal and Fiscal Document Prerequisites. The documents which shall be required prior to the release of state funds shall include the following as appropriate:

(1) a statement as to sufficiency of funds, including proceeds to be derived from sale of bonds to the board and to others and any other available funds to complete the project;

(2) in those projects involving the sale of bonds to the board or to others, a binder of a corporate surety company, to execute good and sufficient payment and performance bonds each in the full amount of the contract price. Such surety company must be authorized to do business in Texas in accordance with Texas Civil Statutes, Article 5160. The board may, at its discretion, waive this requirement for a binder if the chief executive officer of the participating political subdivision and the project engineer certify to the board that the contractor shall not be notified to proceed until the performance bond and payment bond have been executed and filed and the participating political subdivision demonstrates to the board's satisfaction it is financially capable of meeting its bond requirements without income which may be generated from the improvements to be constructed with the bond proceeds;

(3) a certified copy of an escrow agreement providing that funds for construction costs shall be disbursed only in accordance with the provisions of the Texas Water Code. This escrow agreement may be waived if the bond proceedings contain a covenant that construction funds will be disbursed only in accordance with the provisions of the Texas Water Code, and if the applicant demonstrates to the board's satisfaction that it is financially capable of meeting its bond requirements without income which may be generated from the improvements to be constructed with the bond proceeds;

(4) a certified copy of the bond transcript including the ordinance, resolution or similar instrument adopted by the governing body authorizing issuance of bonds sold to the board containing the covenants as agreed upon or as may be required in the board's resolution. The board may require that bond resolutions and covenants reflect provisions consistent with the executive administrator's or development fund manager's approved land acquisition

procedures framed in the application and supporting documents;

(5) if not combined in the preceding document, a certified copy of the ordinance, resolution, or similar instrument adopted by the governing body authorizing issuance of any other bonds to finance the balance of the cost of the project;

(6) bonds delivered in proper form to the office of the State Treasurer, Austin, or other place specified by the development fund manager, accompanied by written instructions for delivering the proceeds of the bonds, i.e., written instructions as to whom the state warrant shall be made payable and to whom it shall be delivered;

(7) a contingently executed copy of each proposed construction contract to be entered into by the participating political subdivision for construction of the projects containing the information required in §363.58(h) of this title (relating to Required Legal Data);

(8) a certified copy of each contract relating to the sale of water by the participating political subdivision;

(9) a certified copy of each contract relating to the purchase or transport of water to the participating political subdivision;

(10) a proposed act of assurance in a form acceptable to the board to be executed by the contractor which shall warrant compliance by the contractor with all laws of the State of Texas and all rules and published policies of the board;

(11) a certified copy of appropriate commission permits for those projects involving the appropriation, impoundment, use, diversion, or transportation of state water or for discharge of waste into or adjacent to water, in the state;

(12) for a wastewater project, evidence of commission approval of plans and specifications;

(13) any further proposed leases or other agreements transferring any interest in land acquired for the project subsequent to those furnished under §363.58(l) of this title (relating to Required Legal Data);

(14) such other instruments or documents as the board may determine to be in the public interest and containing such terms and conditions as the resolution of conditional approval may require; and

(15) approval of project plans and specifications. Water projects funded by the water loan assistance fund or water development fund, water or storage facilities acquisition projects, or structural flood control

projects shall not be eligible for state participation in the event engineering plans and specifications have not been approved by the development fund manager or executive administrator, as appropriate, prior to closing the loan. A water quality enhancement project shall not be eligible for state participation in the event engineering plans and specifications have not been approved by the executive administrator and/or commission, as is appropriate, prior to closing the loan.

§363.85. Water Conservation Program Prerequisites.

(a) Prior to the release of funds, two copies of the applicant's water conservation program, including documentation of local adoption, shall be submitted to and approved by the executive administrator. To the extent personnel are available, the executive administrator may provide technical assistance to an applicant in developing a comprehensive water conservation program that is consistent with the approved conservation plan. The water conservation program shall be developed according to criteria and guidelines for water conservation planning available from the executive administrator. The program shall consist of a long-term water conservation program and an emergency water demand management program.

(b) the long-term water conservation program may include:
  (1) education and information programs;
  (2) plumbing codes or ordinances for water conserving devices in new construction;
  (3) retrofit programs to improve water-use efficiency in existing buildings;
  (4) conservation-oriented water rate structures;
  (5) universal metering and meter repair and replacement;
  (6) leak detection and repair;
  (7) water recycling and reuse;
  (8) water conserving landscaping; and
  (9) means of implementation and enforcement.

(c) the emergency water demand management program shall, at a minimum, include drought contingency plans, and may include:
  (1) education and information programs;
  (2) procedures for program initiation and termination, and emergency response; and
  (3) means of implementation and enforcement.

WATER LOAN ASSISTANCE FUND, FLOOD CONTROL, WATER DEVELOPMENT AND WATER QUALITY ENHANCEMENT PROGRAMS, FINAL PROCEDURES AND REQUIREMENTS
Texas Administrative Code Sections 363.91-363.92

The following rules are promulgated under the authority of Section 6.101, Texas Water Code.

§363.91. Instruments Needed for Closing. Upon approval by the board and/or certification by the development fund manager, the participating political subdivision shall make necessary arrangements with the development fund manager as may be appropriate, consistent with established policy of the board and these sections, for actual transfer of funds from the treasury of the State of Texas to the participating political subdivision and the receipt from the participating political subdivision of those bonds theretofor authorized and issued for the purpose of financing the project. The documents which shall be required at the time of closing shall include the following:

(1) unqualified approving opinions of the attorney general of Texas as to the legality of bonds sold to the board and also as to bonds sold to finance the balance of the project cost. On each of which opinions shall appear a certification from the comptroller of public accounts that such bonds have been registered in that office; and

(2) unqualified approving opinion by a recognized bond attorney acceptable to the board as to legality of bonds sold to the board and to others. Such attorney shall also furnish the board a transcript of bond proceedings relating to the bonds purchased by the board which shall contain those instruments normally furnished a purchaser of a bond issue, but the participating political subdivision need not duplicate any material previously supplied to the board.

§363.92. Escrow of Papers. Any of the instruments required by §363.91 of this title (relating to Instruments Needed for Closing) which cannot be filed prior to delivery of the bonds and payment therefore shall be escrowed in an Austin bank under arrangements which permit their delivery to the board simultaneously with payment for the bonds.

CONSTRUCTION PHASE FOR WATER ASSISTANCE FUND, WATER DEVELOPMENT, FLOOD CONTROL AND WATER QUALITY ENHANCEMENT PROJECTS
Texas Administrative Code Sections 363.101-363.108

The following rules are adopted under the authority Section 6.101, Texas Water Code.

§363.101. Floodplain Management Plan. The floodplain management plan being financed by the board shall include the following:

(1) information on sources of data and records available for the watershed, including a summary of historical flooding in the watershed;

(2) a detailed description of flood situation and flood potential. This should include flood season and flood characteristics, and factors affecting flooding and its impacts;

(3) projections of future flood potential by evaluating flood magnitudes and frequencies, identifying flood hazard areas, flood obstructions, velocities of flow, rates of rise, and duration of flooding. The plan should be based on a statistical 100-year or larger flood as a minimum where substantial property loss and/or risk of life may be possible. Consideration should be given to ultimate anticipated development in the watershed, although a minimum of 20 years of anticipated development in the watershed may be acceptable. The plan should include drainage ways and profiles of water surface elevations;

(4) identification of problems and needs, establishment of objectives, and identification of solutions. The plan should include assessments of costs, benefits, environmental effects and effects of any proposed project on surface water elevations within the watershed and in any adjacent watersheds if applicable. A method for implementation should be included in the plan and the plan should provide for maintenance of flood control facilities;

(5) information on uncontrolled flood-flows in the upstream reaches of the watershed that are outside the boundary of the applicant, and documentation that this information has been taken into account in projecting flood water elevations and in designing structural and non-structural projects; and

(6) sufficient data to demonstrate that flood damage can be reduced or eliminated in existing developed areas as a result of implementing this plan, and that

downstream flooding problems are not significantly increased as the result of the implementation.

§363.102. Final Report of Floodplain Management Plan. Upon completion of the floodplain management plan, ten copies of the plan will be submitted to the Board.

§363.103. Awarding Construction Contracts. The participating political subdivision shall be responsible for assuring that every appropriate procedure and incidental legal requirement is observed in advertising for bids and awarding the construction contract. The text of the construction contract shall not vary from the text of the executive administrator approved pro forma draft submitted by the participating political subdivision.

§363.104. Inspection During Construction. After the construction contract is awarded, the participating political subdivision shall provide for adequate inspection of the project by the project engineer and require his assurance that the work is being performed in a satisfactory manner in accordance with the approved plans and specifications, approved alterations, and in accordance with sound engineering principles and construction practices. The executive administrator is authorized to inspect the construction of any project at any time in order to assure that plans and specifications are being followed and that the works are being constructed in accordance with sound engineering principles and construction practices, but such inspection shall never subject the State of Texas to any action for damages. The executive administrator shall bring to the attention of the participating political subdivision and the project engineer any variances from the approved plans and specifications. The participating political subdivision and the project engineer shall immediately initiate necessary corrective action.

§363.105. Alterations in Approved Plans and Specifications. If after the executive administrator or development fund manager approves engineering plans and specifications it becomes apparent that changes in such plans and/or specifications are necessary or appropriate, a change order and justification therefore shall be submitted for approval, well in advance of the construction alteration when possible. The executive administrator or development fund manager may approve and authorize a change, alteration, or variance in previously approved engineering plans and specifications, including but not limited to additions or deletions of work to be performed pursuant to the contract, if such change, alteration, or variance does not change, vary, or alter the basic purpose or effect of a project, is not a substantial or material alteration in the plans and specifications, and does not increase the loan commitment of the board for the project. Any change, alteration, or variance in the previously approved plans

and specifications which involves an alteration in the basic purpose or effect of a project, substantially or materially alters the previously approved plans and specifications of the project, or which involves an increase in the loan commitment of the board for the project, must be approved and authorized by the board. If there is an immediate danger to life or property, tentative approval of change orders may be secured from the executive administrator or development fund manager via telephone and confirmed by letter or telegraph. A request for a change order should contain sufficient information, with plans or drawings and cost estimates, to enable the executive administrator or development fund manager to review the proposal. Engineering computations shall be included if structural changes are involved. After approval of the proposed alterations by the board, executive administrator or development fund manager, as is appropriate, copies of the approved change order shall be forwarded to the project engineer. If commission approval of plans for a wastewater treatment plant or other facility has been required, commission approval also must be obtained before any substantial or material alteration is made in those plans.

§363.106. Inspection of Materials.

(a) The executive administrator is also authorized to inspect all materials furnished, including inspection of the preparation or manufacture of the materials to be used. A resident engineer or inspector may be stationed at the construction site to report to the executive administrator on the manner and progress of the construction or to report conditions relating to the materials furnished and the compliance by the contractor with approved plans and specifications for the project. Such inspection will not release the contractor from any obligation to perform the work in accordance with the requirements of the contract documents.

(b) In the event construction procedures or materials are determined by the executive administrator to be substandard or otherwise unsatisfactory and/or not in conformity with approved plans and specifications, the executive administrator may order the participating political subdivision to take such action through the project engineer in the manner provided for in the construction contract to correct any such deficiency.

(c) In those instances of dispute between the participating political subdivision's project engineer and the executive administrator's representative as to whether material furnished or work performed conforms with the terms of the construction contract, the executive administrator may order the participating political subdivision to direct the project engineer to reject questionable materials and/or initiate other action provided for in the construction contract, including

suspension where necessary, until all disputed issues are resolved in accordance with the terms of the construction contract.

(d) The contractor shall furnish the executive administrator's representative with every reasonable facility for ascertaining whether the work as performed is in accordance with the requirements and intent of the contract.

(e) The executive administrator or development fund manager is authorized to conduct engineering and financial audits of every project which is financed in whole or in part by Texas water development funds. For purposes of this section, the following definitions are applicable:

(1) Financial audit - A financial audit consists of a review of all the board's files for historical background for the project, a visit to the project offices or site to gather sufficient information to perform a detailed review of documents which substantiate the project expense, a tabulation of expenses, and issuance of an audit report to document the findings.

(2) Engineering audit - An engineering audit consists of a physical inspection of the project to analyze and compare the project with the approved plans and specifications, resulting in the issuance of a technical report which itemizes any variances from the construction contract and approved plans and specifications and recommends corrective action.

(f) In addition to normal testing procedures required of the participating political subdivision, the executive administrator may require reasonable additional tests of construction materials or processes which the executive administrator determines to be necessary during the construction of projects financed in whole or in part by Texas water development funds. All tests, whether for the executive administrator or the project engineer, will conform to current American Water Works Association, American Association of State Highway and Transportation Officials, American Society of Testing and Materials, Texas Department of Highways and Public Transportation published procedures, or similar criteria. The executive administrator shall specify which tests are applicable. Samples for testing shall be furnished free of cost to the executive administrator upon request on the construction site.

§363.107. Certificate of Approval. Upon the resolution of disputes and/or completion of work, the development fund manager shall issue a final, unqualified certificate of completion. This certificate shall be called a certificate of approval.

§363.108. Contractor Bankruptcy. In the event of a contractor bankruptcy, any agreements entered into with the bonding company (other than the bonding company serving as general contractor or fully bonding another contractor acting as their agent) must be submitted for approval of the executive administrator or development fund manager. The participating political subdivision shall be responsible for assuring that every appropriate procedure and incidental legal requirement is observed in advertising for bids and re-awarding a construction contract.

WATER, WASTEWATER AND STORAGE FACILITIES ACQUISITION PROGRAM
Texas Administrative Code Sections 363.111-363.112

The following rules are promulgated under the authority of Section 6.101, Texas Water Code.

§363.111. Master Agreement. The text of the master agreement may encompass the following provisions, where applicable:

(1) with regard to project facilities, including storage, diversion, treatment, wastewater treatment, transportation and collection facilities:
  (A) the formula to be used in determining the cost to the board of acquiring its portion of the project;
  (B) procedures by which development funds shall be made available for payment of the board's portion of the project. See §363.125 of this title (relating to Disbursement of State Funds);
  (C) the character of the interest which the board shall acquire in the facilities, which will customarily be an undivided interest;
  (D) for a federal project, whether the board shall contract on behalf of the participating political subdivisions for the interests to be acquired by them and manner of payment therefor;

(2) contract provisions consistent with the development fund manager's approved land (site) acquisition procedures framed in the participating political subdivision's application and supporting documents;

(3) for a project not constructed by the federal government, the duties and functions of the participating political subdivision for the construction of the project, including the awarding of the construction contract, supervision of construction, and manner of payment to the contractor;

(4) provisions governing lease or rental of lands in which the board has an interest, including the party or parties which shall have the responsibility for such leasing and rental; and the basis of reimbursement to the board for revenues derived therefrom. Such provisions shall include a stipulation that all lease, rental, and other transfers be approved by the development fund manager;

(5) the governmental entity or entities which shall provide for the development and operation of recreational facilities at a reservoir project; and any associated costs.

(6) the governmental entity or entities which shall operate and maintain the board's facilities and the basis of allocation of costs for operation and maintenance between the board and others having an interest in the same facilities;

(7) procedures governing emergency releases of water stored in storage facilities acquired by the board and under the board's control;

(8) provisions governing sales of water by participating political subdivisions to customers who were not foreseen at the time board participation in the project was approved, and the basis of allocation of revenues from such customers between the board and the participating political subdivisions;

(9) requirement that participating political subdivisions shall indemnify and hold harmless the state against any and all claims and causes of action arising from the construction, acquisition, operation, and maintenance of the facilities;

(10) provisions for notice to the participating political subdivisions, storage clients, water clients, water treatment clients, and wastewater treatment clients prior to any sale, transfer, or lease of board-owned facilities or the sale of the use of water, water treatment capacity, wastewater treatment capacity therefrom, and recognizing the preferential right of participating political subdivisions to purchase or lease acquisition facilities, or to purchase the right to use water in storage, or capacity in water and wastewater treatment from the board upon a showing of need;

(11) provision that the board will not compete with participating political subdivisions in the sale of water or the treatment of water or wastewater when such competition will jeopardize the ability of the participating political subdivisions to meet financial obligations for their own water supply and/or water and wastewater treatment projects;

(12) requirement that the participating political subdivision supply the development fund manager with certified copies of all minutes of official actions of the participating political subdivision during the period when construction of the project is in progress and of subsequent action significantly affecting the project:

(13) provisions relating to the interest to be acquired in lands necessary for, or ancillary to, the project;

(14) covenants by the participating political subdivision with respect to inspection standards and techniques, award of contracts, compliance with appropriate

WATER, WASTEWATER AND STORAGE FACILITIES ACQUISITION PROGRAM CONSTRUCTION PHASE
Texas Administrative Code Sections 363.121-363.126

The following rules are promulgated under the authority of Section 6.101, Texas Water Code.

§363.121. General Information. On projects to be constructed or enlarged by a participating political subdivision or subdivisions, one participating political subdivision may be designated under an agreement with the board to act as manager for the project and perform the functions customarily performed by a manager-owner.

§363.122. Awarding Construction Contracts. The designated participating political subdivision shall be responsible for assuring that proper procedures are observed in advertising for bids and selecting the bidder to construct the project. Before notifying the successful bidder or awarding the contract, the designated participating political subdivision shall submit to the executive administrator for review and approval a complete transcript of the bidding procedures which shall consist of: the invitation to bid and the advertisement of bids; bid plans and specifications; names of parties who obtain sets of bidding documents and plans and specifications; a summary of the results of the bid-opening; and a copy of the proposed contract to be awarded. When requested by the board or the executive administrator, the designated participating political subdivision shall also submit information on the qualifications of the contractor or contractors selected to perform the work. The contract shall comply with the provisions of Texas Water Code, §17.135 and §17.279. If the executive administrator approves the bidding procedures, the bidder selected and the proposed construction contract, the designated participating political subdivision shall notify the successful bidder. If the executive administrator disapproves the bidding procedures, the executive administrator shall advise the designated participating political subdivision of the specific matters which must be remedied before the executive administrator will grant approval. After the executive administrator's approval is granted, the successful bidder shall obtain usual and customary insurance for the project and shall execute a contractor's performance bond and a payment bond, as required by Texas Civil Statutes, Article 5160, each with a corporate surety company authorized to do business in Texas and each for 100% of the value of the construction contract. Before the construction contract is awarded, the executive administrator shall approve the insurance and bonds, and the project engineer shall submit a statement to the executive administrator as to the sufficiency of available funds to complete the project.

§363.123. Inspection During Construction. After the construction contract is awarded, the designated participating political subdivision shall provide for adequate inspection of the project by the project engineer and require his assurance that the work is performed in a satisfactory manner in accordance with the approved plans, specifications, and approved alterations, and in accordance with sound engineering principles and practices, but such inspection shall never subject the State of Texas and the Texas Water Development Board to any action for damages. Unless other provisions are contained in the master agreement, the executive administrator's inspector shall bring to the attention of both the project engineer and the designated participating political subdivision any variance from the approved plans and specifications. The participating political subdivision and the project engineer shall immediately initiate necessary corrective action.

§363.124. Alterations in Approved Plans and Specifications. The provisions of §363.105 of this title (relating to Alterations in Approved Plans and Specifications) shall apply to projects contracted under the water, wastewater and storage facilities acquisition program.

§363.125. Disbursement of State Funds. State funds expended for the acquisition and/or development of facilities in a nonfederal project shall be disbursed in accordance with the provisions of the master agreement and any other contracts by the board pursuant thereto, subject to the following: in projects involving the acquisition of land, the board shall not pay or agree to pay any of the costs of land acquisition in advance, but may pay or agree to pay its pro rata portion of such costs as they accrue or on any other reasonable basis agreed to by the board; provided, that if construction is to be paid for as work progresses, the board shall not pay or agree to pay more than 90% of its pro rata portion of the amount due at the time of each progress payment, as certified to by the project engineer; and provided further that the remaining 10% thereunder shall be paid only after approval by the project engineer and, in addition, upon final certification by the development fund manager that work to be performed under the terms of the construction contract has been completed in a satisfactory manner and in accordance with:

(1) approved plans and specifications; and
(2) sound engineering principles and practices. Upon the resolution of any disputes and completion of work, the development fund manager shall issue a final, unqualified certificate of completion. This certification shall be called a certificate of approval.

§363.126. When Project Costs Exceed Estimates. In the event project costs exceed the estimates on the basis of which the

board's commitment has been made, the board may reopen the proceedings in which the original findings approving the project were made, and may hold further meetings or hearings thereon as provided in §363.71 and §363.72 of this title (relating to Formal Action by the Board). The board may request information reasonably necessary for an adequate review of the findings previously made and may amend the prior resolution of approval on the basis of the information developed. Any contracts made pursuant to the original resolution of approval shall likewise be subject to review and may be renegotiated on the basis of amendments to the resolutions. If project costs exceed the estimates, the board may follow any procedure deemed appropriate under the circumstances, including amendment of the resolution and renegotiation of any contracts made pursuant thereto.

APPLICATION TO ACQUIRE STATE INTERESTS OR TO PURCHASE WATER, WATER TREATMENT, OR WASTEWATER TREATMENT
Texas Administrative Code Sections 363.161-363.165

The following rules are promulgated under the authority of Section 6.101, Texas Water Code.

§363.161. Requirements of Application. A prospective storage client, water client, water treatment client, or wastewater treatment client shall make application to the board for the interest it proposes to acquire. The application, together with supplements and exhibits, shall contain the following information in the order listed, as applicable:

(1) name of the applicant and, if a governmental entity, the authority of law under which it was created and operates and date of creation or incorporation;
(2) name, title and address of official correspondent or representative;
(3) if application is by other than an individual, names, and titles of principal officers including the managing official;
(4) name and address of project engineer, if appropriate;
(5) name and address of legal counsel;
(6) statement of project engineer's estimate of cost, itemized as to major facilities or items needed to make use of the facilities to be acquired or used, or of the water to be used;
(7) brief description of the use to be made of the facilities and the places and purposes for which water developed therefrom is to be used or the places or population which the water or wastewater treatment will serve; or a brief description of the use to be made of water diverted from state-owned storage facilities;
(8) if the water to be developed or purchased from the storage facilities is not to be used by applicant, or if the treatment capacity will not be used by applicant, the following information:
    (A) the names or classes of parties to be served by applicant;
    (B) the charges to be made for such service;
    (C) the basis used in determining such charges;
    (D) data showing engineering and economic feasibility of furnishing such services;
(9) for water treatment of wastewater facilities, a brief description and the proposed use of the facilities to be acquired including:
    (A) line and plant capacities available and portion to be acquired;
    (B) areas and population to be served; and

(C) proposed plan for acquiring plant site;

(10) a copy of the permit application submitted to the commission;

(11) proposed transfer agreement covering the points prescribed in §363.165 of this title (Relating to Negotiation of Contracts), as applicable;

(12) information concerning the applicant's water conservation plan, as required in z363.52(b)(12) and (13) of this title (relating to Required General Information).

(13) such additional information as may be required by the board which is reasonably necessary for an adequate understanding of the project.

§363.162. Notice to Participating Political Subdivision and Others. Upon receipt of an application by a prospective water, storage, wastewater, or water treatment client, the board will send notice of its receipt by regular United States mail to all participating political subdivisions, and any water, storage, wastewater, or water treatment clients in the project in question.

§363.163. Consideration by Board. The application shall be scheduled on the board's agenda, and representatives of the prospective client, the participating political subdivisions, other clients in the project, and other interested parties shall be notified of the time the presentation of the application may be made to the board. Consideration of the application may be continued from time to time and from place to place until the board has obtained the information deemed necessary in making the required findings. The board shall approve an application only if the entity has enacted a water conservation plan and program in accordance with this chapter, unless qualifying for an exemption.

§363.164. Resolution Authorizing Transfer. If the board approves the application, a transfer resolution will be adopted which shall prescribe the terms and conditions necessary for the sale, transfer, or lease.

§363.165. Negotiation of Contracts.

(a) Before the board's adoption of the transfer resolution, the executive administrator shall negotiate a transfer agreement with the water, storage, wastewater, or water treatment client to effectuate the sale, transfer, or lease of board-owned interests. The client may not use the project facilities or any water stored in storage facilities until it has been issued the necessary permits by the commission. The transfer agreement shall cover the following points as applicable.

(1) interest transferred:

(A) the character of the interest which is conveyed in the board-owned facilities or in the use of water stored therein;
(B) the formula to be used in computing the price to be paid for the facilities to be acquired, including diversion facilities, or for the purchase of the right to use the facilities or water stored in storage facilities, which formula shall be consistent with the requirements of the Texas Water Code §16.186 and §16.187.

(2) provisions governing lease or rental of facilities or facilities lands in which the state has an interest and the basis of reimbursement to the board for revenues derived therefrom;

(3) the governmental entity or entities which shall provide for the development and operation of recreational facilities at any reservoir and the basis of allocation of costs for operation and maintenance between the board and others owning facilities in the same reservoir;

(4) procedures governing emergency releases of unappropriated public waters stored in storage facilities owned by the board and under the board's control;

(5) requirement that water, storage, water treatment, or wastewater clients shall indemnify and hold harmless the state against any and all claims and causes of action arising from the construction, acquisition, operation, and maintenance of the project;

(6) provision for notice to participating political subdivisions and clients prior to any sale, transfer, or lease of board-owned facilities or the sale of the use of the facility's capacity or water therefrom, and recognizing the preferential right of participating political subdivisions and other political subdivisions to purchase or lease such or similar facilities or to purchase the right of use of the facility's capacity or water in storage from the board;

(7) provisions that the transfer agreement and any other contracts executed with the board pursuant thereto shall be subject to termination by the board upon the failure of a client to make continued payment of the obligations assumed under the contract with the board or upon other breach of the contract. The transfer agreement or other contracts executed with the board pursuant thereto may also be subject to termination by the board if the commission determines that the client has failed to comply with the terms or conditions of the applicable permit.