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MAR 1 3 1990

March 12, 1990

Texas Water Development Board
1700 North Congress Avenue
P.O. Box 13231
Austin, Texas 78711-3231

ATTN: Mr. John Miloy
Water Data Collection, Studies and Planning Division

RE: Bosque County Regional Water Supply Study
Project No. 2719-01

Dear Mr. Miloy:

We are pleased to submit 12 copies of the final report for the Bosque County water supply study. As directed by your comment letter dated February 10, 1990 from Mr. Tommy Knowles, we have contacted Mr. Hayden Whitsett, Environmental Unit, Texas Water Development Board, and requested information pertaining to the preparation of a detailed environmental assessment. We plan to assist the potential users of the system with the preparation of the environmental assessment and the adoption of a drought and water conservation plan as stated in Mr. Knowles' letter.

Thank you again for your assistance and cooperation in the preparation of this document.

Very truly yours,

CARTER & BURGESS, INC.

H. Charles Manning P.E.

H. Charles Manning, P.E.

CM:seb:06714
2719-01

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FORT MYERS, FLORIDA

BOSQUE COUNTY

REGIONAL WATER SUPPLY STUDY

PREPARED FOR

CITY OF CLIFTON, CITY OF MERIDIAN AND TEXAS WATER DEVELOPMENT BOARD

SUBMITTED BY

CARTER & BURGESS, INC.
DALLAS, TEXAS

MARCH 1990

H.C. Manning
3-7-90

STATE OF TEXAS
H. C. MANNING
44709
REGISTERED
PROFESSIONAL ENGINEER

BOSQUE COUNTY REGIONAL
WATER SUPPLY STUDY

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Executive Summary

EXECUTIVE SUMMARY

The purpose of this study is to develop an implementation plan for utilizing Bosque County's share of water from the proposed Lake Bosque. The county's current water rights to the reservoir are contracted by the City of Clifton and the City of Meridian with the Brazos River Authority for a firm yield of 2.98 million gallons per day.

Water demands in the planning area of this study, comprised of Bosque County, are presently being met by water wells. These wells withdraw water from the Travis Peak Formation which has experienced a steady decline in static water levels in recent years due to increasing demands.

This report evaluates four alternative water supply systems to provide for the conjunctive use of surface water and ground water. These alternatives represent various Bosque County participants and supply system requirements.

The recommended alternative consists of a water supply system to provide Lake Bosque water to those cities and major water supply corporations in the county that appear to need additional water supply sources by the end of the planning period, year 2020. This determination was made based on an evaluation of existing well systems and projected average daily demands. These entities include the following:

City of Clifton
City of Meridian
City of Walnut Springs
City of Cranfills Gap
Childress Creek Water Supply Corporation.

The required system components to deliver Lake Bosque water to these entities include a raw water pump station and a water treatment plant to be located just south of the proposed dam. It is recommended that the initial installed capacity of each of these facilities be 2.0 million gallons per day. The supply system also consists of transmission pipelines from the treatment plant to storage facilities owned by each entity and two booster pump stations. The booster pump stations are required to serve Cranfills Gap and Childress Creek Water Supply Corporation.

Cost estimates and deliverable water costs each alternative were prepared based on each participating entity paying for the proportion of the system required to supply their year 2020 average daily demands.

The recommendations of this report do not exclude other cities or water supply corporations within the planning area from participating nor does it require the participation of all entities included. However, this study does present a comprehensive analysis of the water supply system components to serve the planning area with Lake Bosque water and the information presented herein can be used to examine other combinations of participants should the need arise. It also presents cost estimates for the conjunctive use of surface water and ground water for each entity to maximize the benefit of Lake Bosque and to preserve limited ground water supplies.

Section I
Introduction

SECTION I

INTRODUCTION

A. General

The planning area for this study consists of Bosque County, an area of approximately 1010 square miles. Within the planning area are the City of Clifton, City of Meridian, five other incorporated municipalities and three major water supply corporations.

The current population in Bosque County is approximately 15,200 people with 30 percent of the population residing in Clifton and Meridian. It is anticipated that by the year 2020 the population will grow to nearly 22,000 people.

Currently all potable water demands within the planning area are met with water wells. However, continued withdrawals of ground supplies within Bosque County and surrounding counties have resulted in lowering of static water levels. Future water demands in the planning area require the development of alternative water supplies to preserve this limited natural resource and to allow continued growth in the area.

The Brazos River Authority has prepared several reports concerning the development of proposed Lake Bosque. Lake Bosque will impound water in the North Bosque River about 4.5 miles northwest of Meridian. Water will be released downstream for use in Bosque and McLennan Counties. The project is currently scheduled to become operational in 1992.

The Cities of Clifton and Meridian have contracted with the Brazos River Authority for 18.63% of the predicated firm yield of Lake Bosque which equates to 2.98 million gallons per day. This represents the Bosque County current water rights in the proposed reservoir.

This study was jointly funded by the Cities of Clifton and Meridian and the Texas Water Development Board to develop a master plan for the utilization of the Bosque County share of the proposed reservoir yield. This regional plan will result in conversion of the planning area from total ground water dependency to a conjunctive use of surface water and ground water. The plan developed within this study will provide a means for the cities and water supply corporations in the planning area to provide a long term supply of potable water to meet demands throughout the study period of years 1990 through 2020.

B. Scope of Work

The purpose of this study is to develop an implementation plan to utilize Bosque County's share of the proposed reservoir. The following work items were conducted in the course of completing this study:

* Develop water demand projections for the planning area through the year 2020.

* Evaluate existing water supply facilities in the planning area.

* Develop a schematic plan of Lake Bosque water supply systems.
* Select sites for major water supply system facilities.
* Prepare projections of water supply system costs.
* Develop an implementation program for supplementing groundwater with surface water.
* Analyze the impacts of implementing a water conservation plan.
* Develop a plan to best utilize Lake Bosque water.
* Evaluate potential financing alternatives for implementation of recommended improvements.
* Prepare a water conservation plan which emphasizes efficient use of water resources.

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Section II
Water Demand Projections

SECTION II

WATER DEMAND PROJECTIONS

Continued increases in water use in Bosque County have generated concerns about the reliability of ground water supplies to meet water consumption needs in the area. Currently all of the county's domestic water demands are met by ground water. Withdrawals exceed the rate at which ground water can be replenished as demonstrated by a continual lower of the water table. The overuse of this limited natural resource will not only result in a reduction of available water quantity, but it may also result in water of less than desirable quality.

In order to assess the ability of existing water supply systems to meet future needs and to evaluate various water supply alternatives, water demand projections have been developed for the planning period through the year 2020.

A. Population Projections

The primary factors which influence water demands are number of users (population) and the rate of consumption for each user (per capita consumption).

Population projections used for the study are based on projections made by the Texas Water Development Board (TWDB) in September, 1988. The TWDB projections are made for two different population growth rates; low growth series and high growth series.

Population increases can generally be attributed to two factors, migration and a net difference between birth rates and death rates. Migration rates depend largely on economic and employment factors in the county, and therefore, are subject to the greatest amount of variability. The two growth rates projected by the TWDB are primarily based on the anticipation of two different future economic conditions. Population projections for Bosque County for a low growth scenario and a high growth scenario are shown on Tables II-1 and II-2, respectively. The projections are made at 5 year intervals from 1990 to 2020.

The remainder of the county population shown in Tables II-1 and II-2 represents that portion of the population residing in the rural area of Bosque County. The vast majority of these people receive water service from private wells or from one of three major water supply corporations in the county. These corporation's include Childress Creek, Hog Creek and Mustang Water Supply Corporations.

A review of historical records for these corporations from 1980 to 1989 indicate that an average of 2.3 persons can be anticipated per rural service connection. This is also similar to data for Clifton and Meridian.

TABLE II-1

POPULATION PROJECTIONS FOR BOSQUE COUNTY LOW GROWTH SCENARIO

Population Year	Clifton	Meridian	Valley Mills	Iredell	Walnut Springs	Morgan	Cranfills Gap	Remainder of County	Total County Estimate
1980*	3063	1330	1236	407	613	485	341	5926	13,401
1990	3362	1442	1438	456	687	543	382	6718	15,028
1995	3493	1501	1428	478	720	569	400	7170	15,759
2000	3624	1560	1419	500	753	595	419	7620	16,490
2005	3812	1641	1442	524	790	623	440	8021	17,293
2010	4001	1723	1466	548	826	652	460	8421	18,097
2015	4206	1811	1490	574	866	683	482	8854	18,966
2020	4411	1899	1514	600	905	714	504	9289	19,836

* Based on 1980 Census data.
Projections are based on TWDB estimates developed in September, 1988.

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TABLE II-2

POPULATION PROJECTIONS FOR BOSQUE COUNTY HIGH GROWTH SCENARIO

Population Year	Clifton	Meridian	Valley Mills	Iredell	Walnut Springs	Morgan	Cranfills Gap	Remainder of County	Total County Estimate
1980*	3063	1330	1236	407	613	485	341	5926	13,401
1990	3403	1460	1456	461	695	550	387	6795	15,207
1995	3633	1562	1484	497	749	593	417	7458	16,393
2000	3864	1664	1513	533	803	636	447	8120	17,580
2005	4094	1763	1549	563	848	671	472	8608	18,568
2010	4324	1863	1585	593	893	707	497	9095	19,557
2015	4581	1973	1623	626	943	746	525	9638	20,655
2020	4838	2083	1661	660	993	786	553	10,179	21,753

* Based on 1980 census data.
Projections are based on TWDB estimates developed in September, 1988.

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For the purpose of this study, it is assumed that the population served by these water supply corporations will increase at the same growth rate as that shown for the remainder of the county column which is listed on the two previous tables. Tables II-1 and II-2 indicate that the percentage of county population which will be served by the water supply corporations will remain constant through the planning period.

Population projections for these water supply corporations at a low growth and high growth scenario are shown on Tables II-3 and II-4, respectively.

TABLE II-3

POPULATION PROJECTIONS FOR WATER SUPPLY CORPORATIONS LOW GROWTH SCENARIO

YEAR	CHILDRESS CREEK WATER SUPPLY CORP.	HOG CREEK WATER SUPPLY CORP.	MUSTANG WATER SUPPLY CORP.
1980*	1265	380	288
1990	1434	430	325
1995	1531	460	347
2000	1627	488	369
2005	1712	514	388
2010	1798	540	407
2015	1890	567	428
2020	1983	595	449

* Year 1980 population estimate based on number of connections x 2.3 people/connection.

TABLE II-4

POPULATION PROJECTIONS FOR WATER SUPPLY CORPORATIONS HIGH GROWTH SCENARIO

YEAR	CHILDRESS CREEK WATER SUPPLY CORP.	HOG CREEK WATER SUPPLY CORP.	MUSTANG WATER SUPPLY CORP.
1980*	1265	380	288
1990	1451	436	325
1995	1592	478	356
2000	1733	520	387
2005	1838	551	410

TABLE II-4 - (continued)

POPULATION PROJECTIONS FOR WATER SUPPLY CORPORATIONS HIGH GROWTH SCENARIO

POPULATION YEAR	CHILDRESS CREEK WATER SUPPLY CORP.	HOG CREEK WATER SUPPLY CORP.	MUSTANG WATER SUPPLY CORP.
2010	1941	582	433
2015	2057	617	459
2020	2173	651	484

* Year 1980 population estimate based on number of connections x 2.3 people/connection.

B. Per Capita Consumption

Water demand projections for Bosque County are evaluated separately for municipal, agricultural (or rural) and industrial consumers. This is necessary due to the differences in per capita consumption rates between these consumers.

Per capita water consumption rates are influenced by a number of factors including climatic conditions and outside water uses such as lawn watering. The TWDB has developed per capita consumption rates based on historical water use data for years for normal rainfall amounts and for years with drought conditions.

The consumption rates of particular interest for this supply study are average daily consumption and peak day water demand.

Average Daily Consumption - This represents the total water consumed for a year divided by 365 days. This rate is indicative of the total annual water demand.

Peak Day Water Demand - This represents the maximum consumption for one day during a year. This rate typically represents the maximum flow which must be obtained from water supply sources (wells and/or water treatment plants).

For purposes of this study, the TWDB's average daily per capita consumption rates for drought conditions have been used.

Peak day demand rates were developed by analyzing historical water data for the cities of Clifton and Meridian from 1979 to 1989. This data indicates that the peak day demand is approximately 2.7 times the average daily consumption rate. The cities of Clifton and Meridian are considered representative of other communities and customers in Bosque County. Therefore, it is assumed that this peaking factor can be applied throughout the county. Per capita consumption rates for average day and peak day conditions in Bosque County are shown on Table II-5.

TABLE II-5
PER CAPITA WATER CONSUMPTION

CONSUMER	PER CAPITA WATER CONSUMPTION RATES (GAL/CAP-DAY) AVERAGE DAILY*	PEAK DAY**
Clifton	198	534
Meridian	164	442
Valley Mills	155	418
Iredell	139	375
Walnut Springs	139	375
Morgan	139	375
Cranfills Gap	139	375
Rural	139	375

* From TWDB
** Peak day = Avg. day x 2.7

C. Municipal Demand Projections

Municipal water demand projections are based on population projections and per capita consumption rates for each municipality developed by the TWDB. Average daily projections are listed for both low and high growth population projections and are presented in Tables II-6 and II-7, respectively. The demands are shown in million gallons per day (mgd).

TABLE II-6

MUNICIPAL WATER DEMAND PROJECTIONS
AVERAGE DAILY USE FOR
LOW GROWTH SCENARIO

City	Projected Average Daily Water Use (MGD)*						
	1990	1995	2000	2005	2010	2015	2020
Clifton	0.67	0.69	0.72	0.75	0.79	0.83	0.87
Meridian	0.24	0.24	0.25	0.27	0.28	0.29	0.31
Valley Mills	0.22	0.22	0.22	0.22	0.23	0.23	0.23
Iredell	0.06	0.07	0.07	0.07	0.08	0.08	0.08
Walnut Springs	0.10	0.10	0.10	0.11	0.11	0.12	0.13
Morgan	0.07	0.08	0.08	0.08	0.09	0.09	0.10
Cranfills Gap	0.05	0.05	0.06	0.06	0.06	0.07	0.07
TOTAL	1.41	1.45	1.50	1.56	1.64	1.71	1.79

TABLE II-7

MUNICIPAL WATER DEMAND PROJECTIONS
AVERAGE DAILY USE FOR
HIGH GROWTH SCENARIO

City	Projected Average Daily Water Use (MGD)						
	1990	1995	2000	2005	2010	2015	2020
Clifton	0.67	0.72	0.75	0.81	0.85	0.90	0.95
Meridian	0.24	0.25	0.27	0.28	0.30	0.32	0.34
Valley Mills	0.23	0.23	0.23	0.24	0.24	0.25	0.26
Iredell	0.06	0.07	0.07	0.08	0.08	0.08	0.09
Walnut Springs	0.09	0.10	0.11	0.11	0.12	0.13	0.14
Morgan	0.08	0.08	0.08	0.09	0.10	0.10	0.11
Cranfills Gap	0.05	0.06	0.06	0.07	0.07	0.08	0.08
TOTAL	1.42	1.51	1.57	1.68	1.76	1.86	1.97

As can be seen from comparing these two tables, average daily demand does not differ significantly for the two growth scenarios. Therefore, average daily demands for the high growth scenario have been used to evaluate alternatives in this study.

In addition to average daily use, it is important to develop peak day use projections to analyze the ability of existing water supplies to meet periods of high demand. Projected peak day demands for low and high growth scenarios are shown on Tables II-8 and II-9, respectively.

TABLE II-8

MUNICIPAL WATER DEMAND PROJECTIONS
PEAK DAY USE FOR
LOW GROWTH SCENARIO

City	Projected Average Daily Water Use (MGD)						
	1990	1995	2000	2005	2010	2015	2020
Clifton	1.80	1.87	1.94	2.04	2.14	2.25	2.36
Meridian	0.64	0.66	0.69	0.73	0.76	0.80	0.84
Valley Mills	0.60	0.60	0.59	0.60	0.61	0.62	0.63
Iredell	0.17	0.18	0.19	0.20	0.21	0.22	0.23
Walnut Springs	0.26	0.27	0.28	0.30	0.31	0.32	0.34
Morgan	0.20	0.21	0.22	0.23	0.25	0.26	0.27
Cranfills Gap	0.14	0.15	0.16	0.17	0.17	0.18	0.19
TOTAL	3.81	3.94	4.07	4.27	4.45	4.65	4.86

* Peak day = Avg. day x 2.7

TABLE II-9

MUNICIPAL WATER DEMAND PROJECTIONS
PEAK DAY USE FOR
HIGH GROWTH SCENARIO

City	Projected Average Daily Water Use (MGD)						
	1990	1995	2000	2005	2010	2015	2020
Clifton	1.81	1.94	2.06	2.19	2.31	2.44	2.58
Meridian	0.64	0.69	0.74	0.78	0.82	0.87	0.92
Valley Mills	0.61	0.62	0.63	0.65	0.66	0.68	0.70
Iredell	0.17	0.19	0.20	0.21	0.22	0.23	0.25
Walnut Springs	0.26	0.28	0.30	0.32	0.34	0.35	0.37
Morgan	0.21	0.22	0.24	0.25	0.27	0.28	0.29
Cranfills Gap	0.15	0.16	0.17	0.18	0.19	0.20	0.21
TOTAL	3.85	4.10	4.34	4.58	4.81	5.05	5.32

* Peak day = Avg. day x 2.7

As shown in Tables II-8 and II-9, the peak day demand projections for the high growth scenario are approximately 10% higher than those for the low growth scenario in the year 2020. The peak day demands for the high growth scenario have been used in this study.

D. Rural Demand Projections

Rural water demand projections are based on population projections and per capita consumption rates developed by the TWDB. These projections reflect demands anticipated to be met by the three major water supply corporations in Bosque County. Childress Creek, Hog Creek and Mustang Water Supply Corporations serve the majority of rural customers relying on an approved public water supply system.

Projected average daily rural use for low and high growth scenarios are shown on Tables II-10 and II-11, respectively.

TABLE II-10

RURAL WATER DEMAND PROJECTIONS
AVERAGE DAILY USE FOR
LOW GROWTH SCENARIO

Water Supply Corporation	Projected Average Daily Use (MGD)						
	1990	1995	2000	2005	2010	2015	2020
Childress Creek	0.20	0.21	0.23	0.24	0.25	0.26	0.27
Hog Creek	0.06	0.06	0.07	0.07	0.07	0.08	0.08
Mustang	0.04	0.04	0.05	0.05	0.06	0.06	0.06
TOTAL	0.30	0.31	0.35	0.36	0.38	0.40	0.41

TABLE II-11

RURAL WATER DEMAND PROJECTIONS
AVERAGE DAILY USE FOR
HIGH GROWTH SCENARIO

Water Supply Corporation	Projected Average Daily Use (MGD)						
	1990	1995	2000	2005	2010	2015	2020
Childress Creek	0.20	0.22	0.24	0.25	0.27	0.28	0.30
Hog Creek	0.06	0.07	0.07	0.08	0.08	0.09	0.09
Mustang	0.04	0.05	0.05	0.05	0.06	0.06	0.07
TOTAL	0.30	0.34	0.36	0.38	0.41	0.43	0.46

Using a peaking factor of 2.7 times average daily demand, peak day rural demands were developed for low and high growth scenarios and are shown on Tables II-12 and II-13, respectively.

TABLE II-12

RURAL WATER DEMAND PROJECTIONS
PEAK DAY USE FOR
LOW GROWTH SCENARIO

Water Supply Corporation	Projected Peak Day Use (MGD)						
	1990	1995	2000	2005	2010	2015	2020
Childress Creek	0.54	0.57	0.61	0.64	0.67	0.71	0.74
Hog Creek	0.16	0.17	0.18	0.19	0.20	0.21	0.22
Mustang	0.11	0.13	0.14	0.15	0.15	0.16	0.17
TOTAL	0.81	0.87	0.93	0.98	1.02	1.08	1.13

TABLE II-13

RURAL WATER DEMAND PROJECTIONS
PEAK DAY USE FOR
HIGH GROWTH SCENARIO

Water Supply Corporation	Projected Peak Day Use (MGD)						
	1990	1995	2000	2005	2010	2015	2020
Childress Creek	0.54	0.57	0.61	0.65	0.69	0.77	0.82
Hog Creek	0.16	0.18	0.19	0.21	0.22	0.23	0.24
Mustang	0.11	0.13	0.14	0.15	0.16	0.17	0.17
TOTAL	0.81	0.88	0.94	1.01	1.07	1.17	1.23

As with municipal demand projections, rural demand projections do not vary significantly between the two growth scenarios. Therefore, the high growth scenario demand projections have been used for analyses purposes.

E. Industrial Demand Projections

The predominant economic base for Bosque County is agriculture. There is very little industry in the county and only one customer that uses a significant amount of water, that being Chemical Lime located between Clifton and Valley Mills.

Typically, daily water consumption for light industry remains fairly constant and does not experience the demand peaks associated with domestic consumption. Additionally, average daily demand remains fairly constant from year to year and generally only changes significantly when a plant is expanded, a new plant is opened or when manufacturing processes are dramatically altered. Therefore, of primary concern for industrial consumers is average daily use.

Because such demand increases are difficult to anticipate and depend on changes in economic climate, it is assumed that a constant 1.5% annual demand increase will be experienced by these consumers. This rate closely parallels that of the high growth population series developed for municipal and rural customers. Industrial demand projections are shown on Table II-14.

TABLE II-14

INDUSTRIAL WATER DEMAND PROJECTIONS
AVERAGE DAILY USE

	Average Daily Use (MGD)						
Industry	1990	1995	2000	2005	2010	2015	2020
West Pac	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Plantation Foods	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Chemical Lime	0.52	0.56	0.60	0.65	0.70	0.75	0.81
TOTAL	0.54	0.58	0.62	0.67	0.72	0.77	0.85

Of these three industrial consumers, West Pac and Plantation Foods are served by the City of Clifton. It is anticipated that their demands will not increase significantly and that they will continue to be served by Clifton.

Chemical Lime is by far the greatest industrial water consumer in the planning area and is primarily served by three water wells located at the plant site. A small percent is purchased from Childress Creek Water Supply Corporation.

F. Demand Reductions Resulting from Conservation Practices

The availability of adequate water supplies to meet future demands is essential to Bosque County and is an ever growing concern across the state. The development of Lake Bosque will supplement the increased demands being placed on ground water supplies. However, the quantity of water available to consumers now and in the future is limited. It is imperative that this natural resource be used wisely and with conservation for future needs in mind.

The Brazos River Authority (BRA) has prepared a report published in 1988 entitled "Water Conservation and Drought Contingency Plan for the Brazos River Authority and Lake Bosque Project Participants". The purpose of this plan is to maximize the beneficial use of water supplies developed by the Lake Bosque Project. A Water Conservation Plan and Drought Contingency Plan is a requirement of the Texas Water Development Board (TWDB) for receiving financial assistance from the Development Fund or the Water Loan Assistance Fund.

The plan prepared by BRA outlines key water conservation planning elements dictated by the TWDB. The Lake Bosque Participants, which includes Clifton and Meridian, have committed contractually to the water conservation plan.

Assuming a net annual increase in population, a reduction in projected water consumption will require a reduction in the amount of water consumed by each individual. The most important factor is reducing per capita consumption is education of the consumer to make them aware of the amount of water required to perform daily functions and how to reduce the amount used.

The Texas Water Development Board has established projected per capita water consumption rates based on the progressive implementation of conservation practices beginning in 1990.

Table II-15 shows reduced per capita water consumption rates for average daily use as developed by the TWDB and for peak day use assuming a peaking factor of 2.7 times average daily demand. This peaking factor may be somewhat conservative and may actually be lower as conservation practices are implemented and daily demand fluctuations are dampened. Table II-15 reflects per capita consumption rates for high use or drought conditions.

TABLE II-15

PER CAPITA WATER CONSUMPTION REFLECTING CONSERVATION PRACTICES

Consumer	Base Rate Without Conservation	Per Capita Water Consumption Rates (GAL/CAP-DAY)						
		1990	1995	2000	2005	2010	2015	2020
Clifton								
average daily*	198	193	188	183	178	173	170	168
peak day**	534	521	508	494	480	467	460	453
Meridian								
average daily	164	160	155	151	147	143	141	139
peak day	442	432	420	407	397	386	381	375

TABLE II-15 (continued)

PER CAPITA WATER CONSUMPTION
REFLECTING CONSERVATION PRACTICES

Consumer	Base Rate Without Conservation	Per Capita Water Consumption Rates (GAL/CAP-DAY) 1990	1995	2000	2005	2010	2015	2020
Valley Mills								
average daily	155	151	147	143	139	135	133	131
peak day	418	408	397	387	375	366	359	355
Remainder of Bosque Co.								
average daily	139	135	132	128	124	121	120	118
peak day	375	366	355	347	336	328	323	319

* Average daily rates are from the Texas Water Development Board and reflect high use or drought conditions.
** Peak day = Avg. daily x 2.7

To illustrate the potential savings in water consumption that can be realized by these reduced per capita rates, Tables II-16 and II-17 shows water demand projections for a high growth series average daily and peak day demands, respectively.

TABLE II-16

WATER DEMAND PROJECTIONS
REFLECTING CONSERVATION PRACTICES
AVERAGE DAILY USE
HIGH GROWTH SCENARIO

City or Supply Corporation	Projected Average Daily Water Use (MGD) 1990	1995	2000	2005	2010	2015	2020
Clifton	0.66	0.68	0.71	0.73	0.75	0.78	0.81
Meridian	0.23	0.24	0.25	0.26	0.27	0.28	0.29
Valley Mills	0.22	0.22	0.22	0.22	0.21	0.21	0.22
Iredell	0.06	0.06	0.07	0.07	0.07	0.08	0.08
Walnut Springs	0.09	0.10	0.10	0.11	0.11	0.11	0.12
Morgan	0.07	0.08	0.08	0.08	0.09	0.09	0.09
Cranfills Gap	0.05	0.05	0.06	0.06	0.06	0.06	0.07
Childress Creek Corporation	0.20	0.21	0.21	0.21	0.22	0.23	0.23
Hog Creek Corporation	0.06	0.06	0.06	0.06	0.06	0.07	0.07
Mustang Corporation	0.04	0.04	0.05	0.05	0.05	0.05	0.05
TOTAL	1.68	1.74	1.81	1.85	1.89	1.96	2.03

For the cities of Clifton and Meridian the implementation of these conservation practices could translate into a combined average day savings of 190,000 gallons per day by the year 2020. This translates into a savings of 69 million gallons a year. For all entities combined the average day savings is 400,000 gallons per year by 2020, translating into a reduction in water consumption of 146 million gallons per year.

TABLE II-17

WATER DEMAND PROJECTIONS
REFLECTING CONSERVATION PRACTICES
PEAK DAY USE
HIGH GROWTH SCENARIO

	Projected Peak Day Water Use (MGD)						
City of Supply Corporation	1990	1995	2000	2005	2010	2015	2020
Clifton	1.78	1.84	1.92	1.97	2.02	2.11	2.19
Meridian	0.62	0.65	0.68	0.70	0.73	0.76	0.78
Valley Mills	0.59	0.59	0.59	0.58	0.57	0.57	0.58
Iredell	0.16	0.17	0.19	0.19	0.20	0.21	0.21
Walnut Springs	0.24	0.27	0.28	0.29	0.30	0.31	0.32
Morgan	0.19	0.21	0.21	0.22	0.23	0.23	0.24
Cranfills Gap	0.13	0.14	0.16	0.16	0.17	0.18	0.19
Childress Creek Corporation	0.54	0.56	0.57	0.58	0.60	0.61	0.62
Hog Creek Corporation	0.16	0.16	0.17	0.17	0.18	0.18	0.19
Mustang Corporation	0.10	0.11	0.13	0.14	0.14	0.14	0.14
TOTAL	4.51	4.70	4.90	5.00	5.14	5.30	5.46

The implementation of conservation practices could reduce the peak day demand for Clifton and Meridian by 230,000 gallons per day. Since peak day demands are typically used to size infrastructure such as treatment plants and transmission pipelines, a reduction of this amount of demand could result in construction cost savings for these items as well as operations cost savings associated with treatment and pumping.

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Section III
Existing Water Supply Facilities

SECTION III

EXISTING WATER SUPPLY FACILITIES

A. Ground Water Production Facilities

Water demands in Bosque County are currently supplied with ground water wells. The principal aquifer which provides ground water in Bosque County is the Travis Peak Formation. This formation, in much of the region, is composed of an upper sand unit (Upper Trinity Sand), a middle argillaceous unit (clay and shale layer) and a lower sand unit (Lower Trinity Sand). The upper sand layer is also termed the Hensell Member and consist of sand, sand stone, conglomerate, shale, clay and some limestone. The lower sand layer, termed the Hosston Member, generally consists of a similar group of sands and clays to the Hensell Member with the exception of the absence of the limestone layer.

The Travis Peak Formation outcrops in approximately ten counties within the Bosque County region. The more important occurances are found in Erath, Eastland, Hamilton and Hood Counties.

The most important water bearing sand is the Hosston Member (Lower Trinity Sand). This formation dips in a southeast direction from its outcrop locations that are north and northwest of Bosque County. Within Bosque County the elevation of the top of the Hosston Member is approximately elevation 600 in the northwest to about 500 feet below sea level in the southeast. This layer is about 700 feet below ground at Meridian and about 900 feet within the City of Clifton.

The thickness of the Hosston Unit varies widely over the entire region but ranges from approximately 50 feet in northwest Bosque County to about 150 feet in the southeast corner of the county. Figure III-1 shows a geologic cross section of the soil formations within the Bosque County region.

The City of Meridian currently operates three water wells to furnish water for its customers. These wells range in depth from 710 feet to 830 feet. One well is currently located in the Hensell Member while the remaining wells take water from the Hosston Member. Figure III-2 shows a general profile of the subsurface strata and the location of the well points.

Clifton, like Meridian, also operates five wells to furnish city water. These wells all appear to be located in the Hosston Member of the Travis Peak Formation. The Clifton wells were placed deeper than the wells in Meridian due to the dip of the formation as it progresses in a southeast direction. Figure III-3 shows a general profile of the subsurface strata and the location of the well points.

It is estimated by the Texas Department Board in Report No. 195 that the highest anticipated recharge rate for this aquifer is approximately 40,000 acre-feet per year. A recent study prepared for the TWDB on the Whitney Area estimates a total yearly consumption from the Trinity Aquifer of 65,000 acre feet per year. The disparity between recharge rates and withdrawal rates from the aquifer has resulted in a steady decline of static water levels.

Discussions with operating personnel and a review of well reports from surrounding communities indicate that the water level within the Lower Trinity Sand has been dropping from eight to twelve feet per year. Noting that counties north of Bosque County, namely Erath, Sommerville and Hood, are growing both in population and water use, it is expected that the water level in the Lower Trinity will continue to drop, since most of the water used by these communities is currently obtained from water wells.

An inventory of existing water wells owned and operated by cities and major water supply corporations in Bosque County are shown in Table III-1.

TABLE III-1

BOSQUE COUNTY
GROUNDWATER PRODUCTION FACILITY INVENTORY

CITY OR SUPPLY CORPORATION	# WELLS	CAPACITY: GALLONS PER MINUTE (GPM)	CAPACITY: MILLION GALLONS PER DAY (MGD)
Clifton	4	300	
		310	
		250	
		210	
		1,070	1.54
Meridian	3	185	
		215	
		225	
		625	0.90
Iredell	2	100	
		100	
		200	0.29
Walnut Springs	2	120	
		120	
		240	0.34
Morgan	2	130	
		200	
		330	0.47
Cranfills Gap	3	20	
		25	
		25	
		70	0.10
Valley Mills	2	265	
		300	
		565	0.81
Childress Creek Water Supply Corporation	2	160	
		160	
		210	
		530	0.76
Hog Creek Water Supply Corporation	2	100	
		100	
		200	0.29
Mustang Water Supply Corporation	4	100	
		85	
		85	
		25	
		295	0.42

The location of these wells is shown on Figure III-4. The well capacities shown reflect rated conditions of each facility. Generally, each well is operating approximately at its rated condition. However, with limited ground water recharge rates and increasing consumption demands, well production rates will decline. In order to meet increased water needs in Bosque County with ground water, it may be required to drill additional wells. It should be noted that the production rate for new wells will drop as the ground water source is diminished.

B. Water Storage and Distribution Facilities

The storage facilities in Bosque County generally consist of ground storage tanks. Many of these tanks are located at elevations sufficiently greater than the area they service so as to function as elevated storage. An inventory of storage facilities in the planning area are shown on Table III-2.

TABLE III-2

BOSQUE COUNTY
WATER STORAGE FACILITY INVENTORY

CITY OR SUPPLY CORPORATION	NUMBER OF TANKS	CAPACITY (GAL)
Clifton	4	200,000 Standpipe 50,000 Ground Tank* 200,000 Ground Tank* 200,000 Ground Tank* 650,000 Total Storage
Meridian	2	100,000 Elev. Tank 250,000 Ground Tank* 350,000 Total Storage
Valley Mills	2	100,000 Ground Tank* 100,000 Ground Tank* 200,000 Total Storage
Iredell	2	25,000 Ground Tank 25,000 Ground Tank 50,000 Total Storage
Walnut Springs	1	190,000 Ground Tank* 190,000 Total Storage
Morgan	2	50,000 Elev. Tank 37,500 Ground Tank 87,500 Total Storage
Cranfills Gaps	3	22,000 Ground Tank* 22,000 Ground Tank* 50,000 Standpipe 94,000 Total Storage
Childress Creek Water Supply Corp.	4	140,000 Standpipe 140,000 Standpipe 40,000 Ground Tank* 40,000 Ground Tank* 360,000 Total Storage
Hog Creek Water Supply Corp.	2	25,000 Ground Tank* 25,000 Ground Tank* 50,000 Total Storage
Mustang Water Supply Corp.	4	40,000 Standpipe 50,000 Standpipe 50,000 Standpipe 8,000 Standpipe 148,000 Total Storage

* Denotes ground tanks that serve as elevated storage.

The location of these storage facilities in the planning area are shown in Figure III-4.

The Texas Department of Health has established minimum storage capacities for community public water systems based on the number of connections served. The requirements are established for both elevated storage and total storage. However, the overriding minimum requirement is that the system maintain a minimum residual pressure of 20 psi at all points in the distribution system under peak demand conditions. Minimum water storage requirements for the major public water systems in the planning area are shown on Table III-3.

TABLE III-3

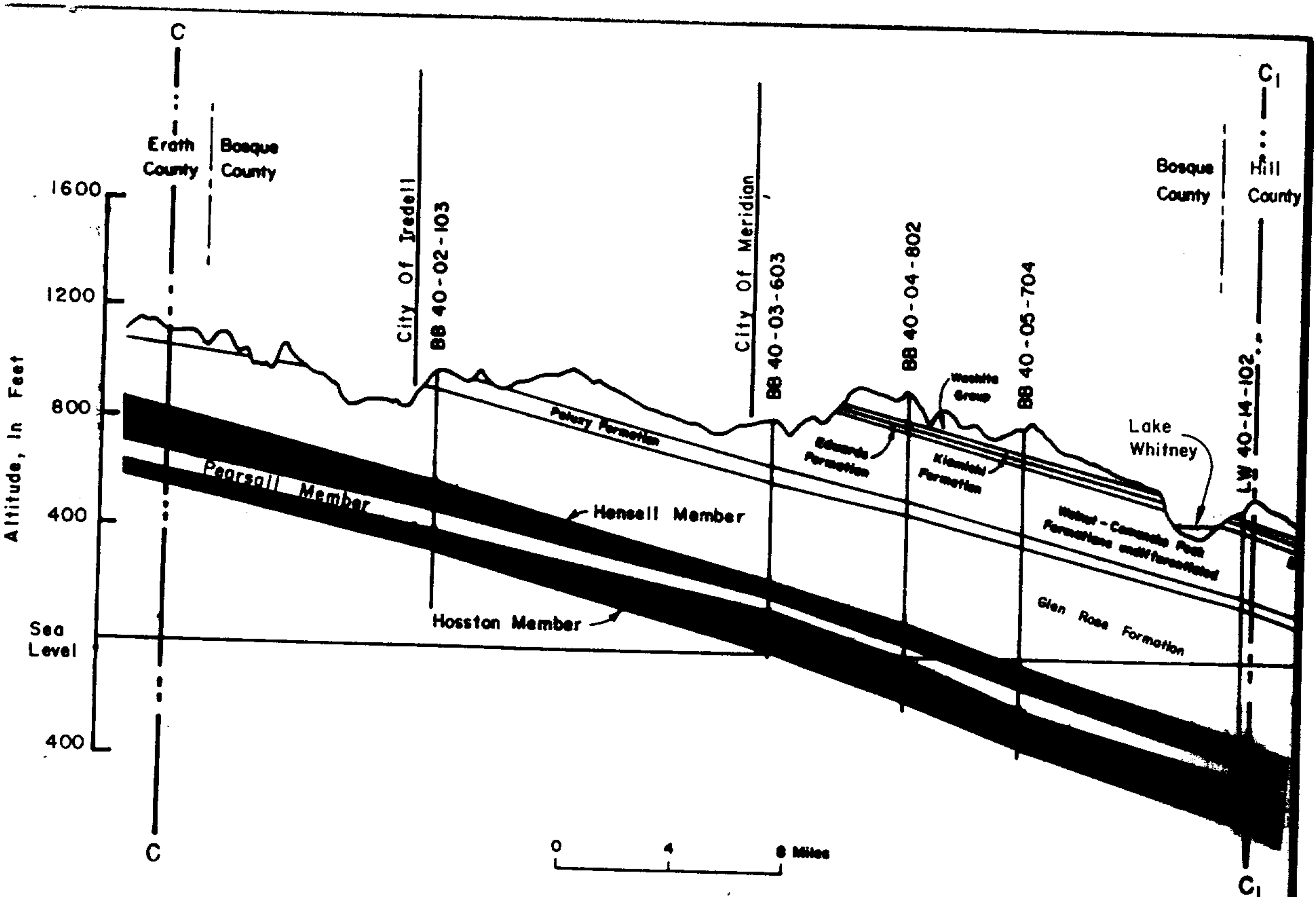
BOSQUE COUNTY
MINIMUM WATER STORAGE REQUIREMENTS

CITY OR SUPPLY CORPORATION	NUMBER OF CONNECTIONS	MINIMUM REQUIRED STORAGE* (gallons)		PRESENT STORAGE CAPACITY (gallons)	
		ELEVATED	TOTAL	ELEVATED	TOTAL
Clifton	1475	147,500	295,000	650,000	650,000
Meridian	630	63,000	126,000	350,000	350,000
Valley Mills	630	63,000	126,000	200,000	200,000
Iredell	195	19,500	39,000	0	50,000
Walnut Springs	300	30,000	60,000	190,000	190,000
Morgan	235	23,500	47,000	50,000	87,500
Cranfills Gap	165	16,500	33,000	94,000	94,000
Childress Creek Corp.	625	62,500	125,000	360,000	360,000
Hog Creek Corp.	185	18,500	37,000	50,000	50,000
Mustang Corp.	135	13,500	27,000	140,000	148,000

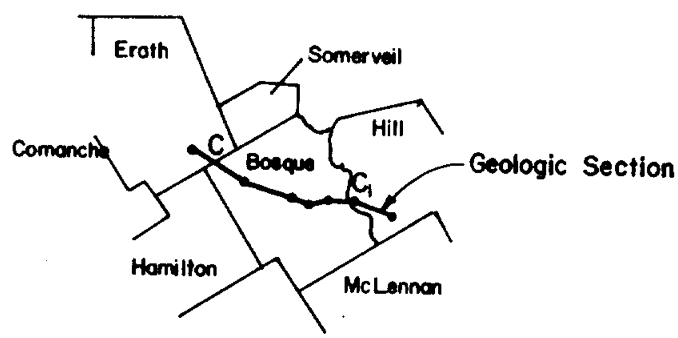
* Based on Texas Department of Health minimum storage requirements as follows:

(1) An elevated storage capacity of 100 gallons/connection.
(2) A total storage capacity of 200 gallons/connection.

All public systems in the planning area surpass the minimum total storage requirements and all systems except Iredell meet the minimum elevated storage requirements. The City of Iredell maintains pressure in their distribution system with two 5-horsepower horizontal split case pumps rated at 120 gallons/minute.



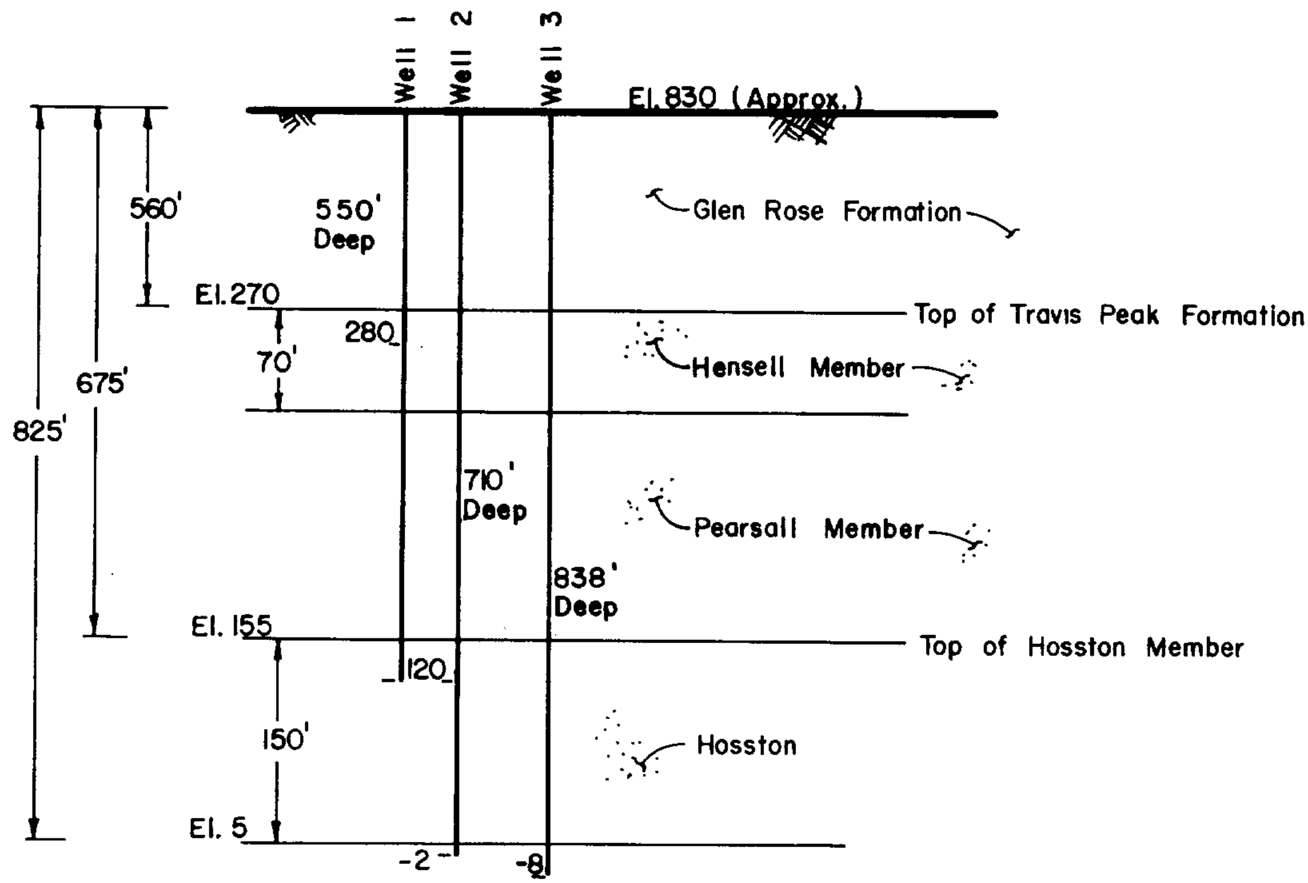
Geologic Section



GEOLOGIC SECTION BOSQUE COUNTY

DANNENBAUM ENGINEERING CORPORATION

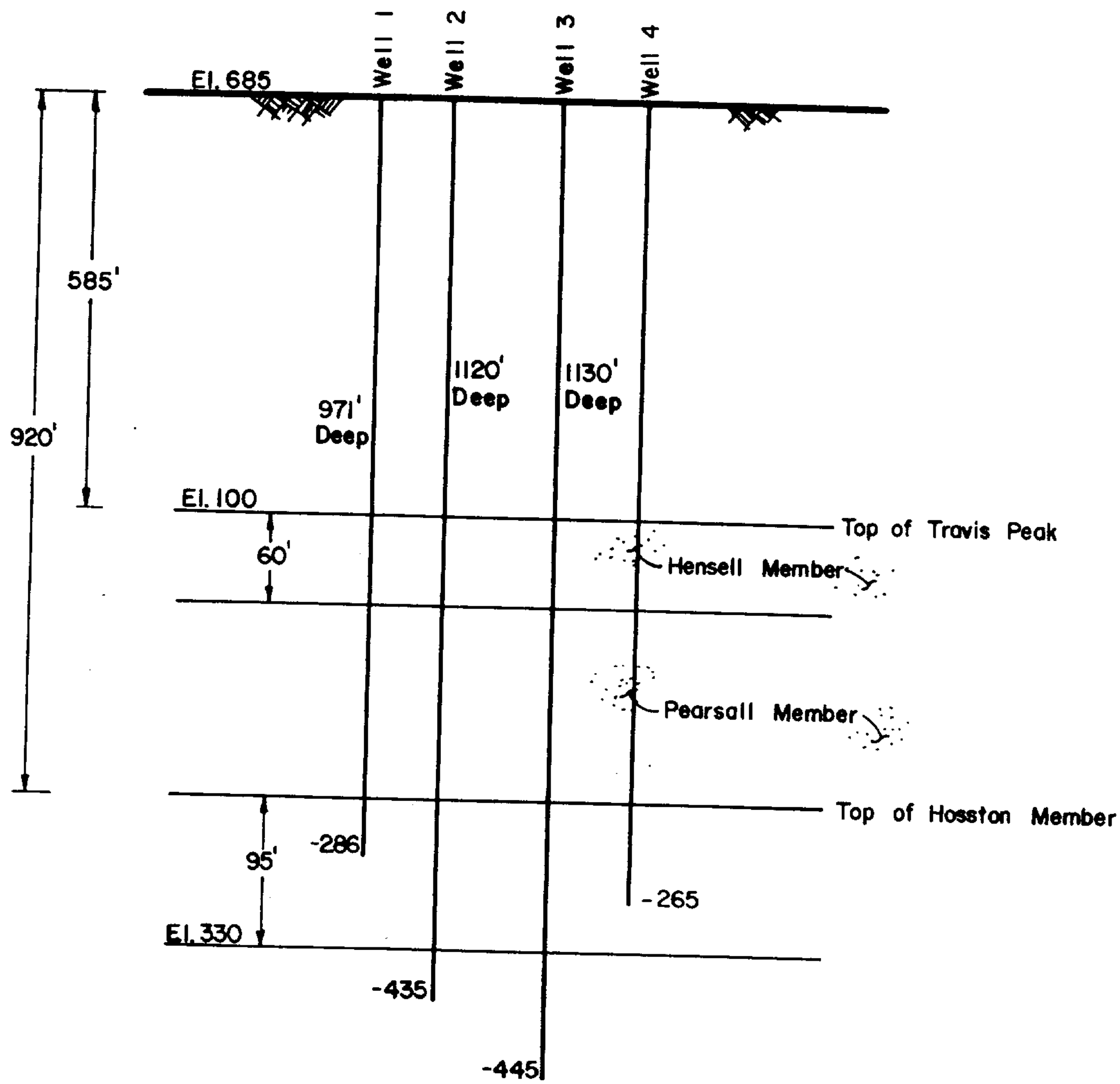
FIGURE III-1



WATER WELL PROFILE
CITY OF MERIDIAN

DANNENBAUM ENGINEERING CORPORATION

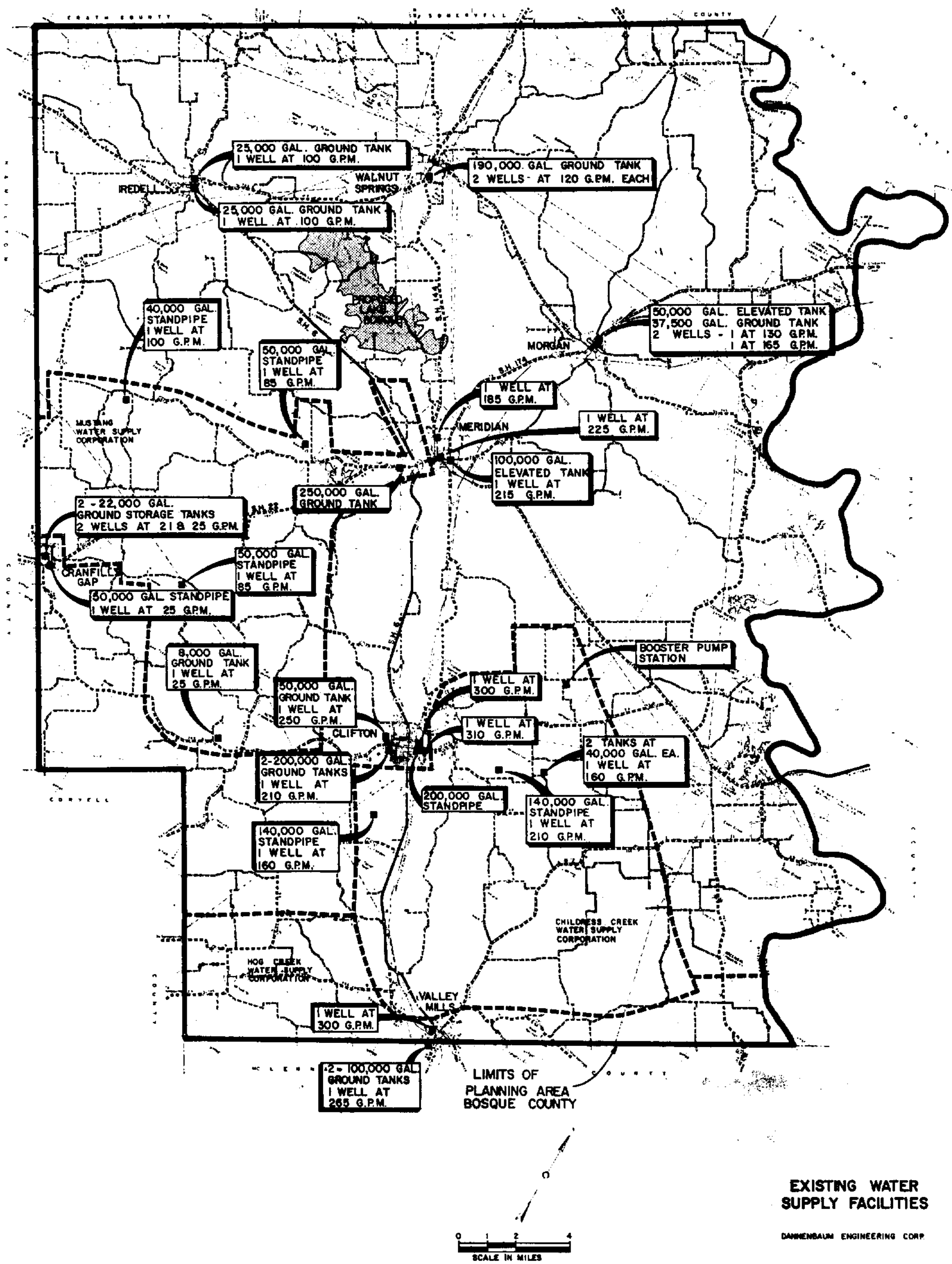
FIGURE III-2



WATER WELL PROFILE
CITY OF CLIFTON

DANNENBAUM ENGINEERING CORPORATION

FIGURE III - 3



EXISTING WATER SUPPLY FACILITIES

DANNENBAUM ENGINEERING CORP.

FIGURE III - 4

Section IV
Schematic Plan and Lake Bosque Water Supply System

SECTION IV

SCHEMATIC PLAN
OF LAKE BOSQUE WATER SUPPLY SYSTEMS

This section outlines and discusses the key elements utilized in four alternative schematic plans. The key elements include Lake Bosque, a water treatment plant, transmission lines, meter stations and related pumping facilities. The alternative plans which are presented describe a minimum system which serve Clifton and Meridian, a system which serves all cities and water supply corporations within Bosque County and a system which only serves those entities who appear to need additional water in year 2020.

A. Lake Bosque

The embankment for the proposed Lake Bosque Project and associated facilities are to be located approximately 4.5 miles northwest of Meridian between State Highways 6 and 144. The dam will impound water in the North Bosque River and be operated by the Brazos River Authority (BRA) in coordination with Lake Waco for the purpose of providing a long term, firm surface water supply for Bosque County and other participants.

Lake Bosque will initially impound 112,438 acre feet of water at the planned conservation pool elevation of 830 feet, mean sea level (MSL). In a report prepared for BRA in May, 1988 entitled "Lake Bosque Intake Alternative for the Cities of Clifton and Meridian, Texas", the long term (year 2040) dependable yield of Lake Bosque was determined to be 15.98 mgd (million gallons per day).

The Cities of Clifton and Meridian have entered into water supply contracts with BRA for a total of 18.63% (2.98 mgd) of the predicted Lake Bosque dependable yield. Of the 2.98 mgd, Clifton has contracted for 58.62% (1.75 mgd) and Meridian has contracted for 41.38% (1.23 mgd). The execution of these contracts is contingent upon the issuance of a permit by the Texas Water Commission (TWC) authorizing the proposed Lake Bosque Project. For purposes of this study, it is assumed the TWC will approve the submitted application for the entire predicted year 2040 dependable yield.

The proposed diversion point for water contracted by Lake Bosque participants is located at the downstream side of the dam and on the east side of the Bosque River. In a report prepared for BRA and the Cities of Clifton and Meridian in May, 1988, it was determined that the most cost effective form of diversion is a combined intake and outlet facility constructed at the time the dam is constructed. The outlet pipeline through which the Bosque County participants are to divert water was sized to be 24" in diameter.

B. Water Supply System Alternatives

A schematic plan of Lake Bosque water supply systems involves diverting water from this downstream point to a surface water treatment plant and then conveying the treated water to consumers. The water supply system will consist of the following primary components:

* Raw water pump station
* Raw water pipeline
* Water treatment plant
* High service and/or booster pump stations
* Transmission pipelines
* Meter stations

As discussed in the previous chapter, there are a number of Bosque County cities and water supply corporations (WSC) who may elect to participate in the Lake Bosque Project. Depending on which cities or WSC joins the system, there are many combinations of alternative routes which may be employed to deliver treated water.

A total of four water supply system alternatives were evaluated to allow municipalities and water supply corporations within the planning area to meet future water demands. The water supply system alternatives evaluated are listed below:

Alternative No. 1 — Clifton and Meridian utilize surface water to meet average daily demands. Initial water supply system installed for year 2020 projected demands.

Alternative No. 2 — All cities and major water supply corporations in the planning area utilize surface water to meet average daily demands. Initial water supply system installed for year 2020 projected demands.

Alternative No. 3 — Clifton and Meridian utilize utilize surface water to meet average daily demands. Initial water supply system installed to handle 100% of Clifton and Meridian's contracted water rights (2.98 mgd).

Alternative No. 4 — Only those cities and major water supply corporations that appear to need additional water supplies by year 2020 utilize surface water to meet average daily demands. Initial water supply system installed for year 2020 projected demands.

Each of the alternatives evaluated in this study are based on the Lake Bosque water treatment plant and transmission system being design to meet average daily demands. Water demands in excess of average daily demands will be supplied by existing water wells. Water demands exceeding average daily demands can most economically be met by the conjunctive use of existing water wells and storage facilities.

Each of the alternatives evaluated assume initial surface water utilization begins in the year 2000. A time period at approximately ten years has been incorporated to allow time for issuance of the Lake Bosque project permit, land acquisition, dam and intake/outlet structure construction, lake impoundment and design and construction of corresponding water supply system components.

Alternative No. 1

Water supply system alternative No. 1 assumes that during the planning period Clifton and Meridian are the only entities in the planning area to utilize surface water to supplement ground water supplies. Under this scenario the water supply system consists of a raw water pump station and pipeline to convey raw water to a water treatment plant located on the west side of State Highway 144 and just south of the proposed dam. The system would also consist of a transmission pipeline and pump station to deliver water to Meridian and Clifton. A schematic plan for this alternative is shown on Figure IV-1.

Water Treatment Plant

The water treatment would be installed with an initial design capacity of 1.5 mgd. This capacity will meet the combined average daily demands for Clifton and Meridian in the year 2000 (1.02 mgd) and year 2020 (1.29 mgd). The additional capacity is desireable in the event that an existing water well experiences a reduction in capacity, begins to produce water of less than desireable quality or otherwise becomes inoperable.

The treatment plant also includes treated water storage volume equal to one full day's plant production, 1.5 million gallons. This storage allows treated water to be supplied at the plant capacity for one day in the event that plant production is interrupted. Additional storage also allows for the plant to be operated at a constant rate and meet diurnal fluctuations in water demand.

Pipelines

The pipelines required for this alternative include a 12" diameter raw water pipeline from the Lake Bosque outlet pipe to the treatment plant and a 12" diameter transmission pipeline from the treatment plant to Meridian and Clifton. These pipe sizes will allow the conveyance of average daily demands to Clifton and Meridian at desirable operating pressures with a maximum system pressure of approximately 140 psi (pounds per square inch). Pumps would be selected for this conveyence system to deliver water directly from a high service pump station at the treatment plant to both Clifton and Meridian.

The raw water pipeline would be located just south of the dam. Transmission pipelines A and B can be installed within existing rights-of-way for S.H. 144, S.H. 22 and S.H. 6, thus avoiding the need for easement acquisition along the vast majority of the alignment. Transmission pipelines A1 and A2 (6" diameter each) can also be located within the rights-of-way for S.H. 22 and F.M. 2840.

Transmission pipelines A, B, A1 and A2 provide for delivering water to two existing tanks in both Meridian and Clifton. This will allow for more reliable delivery to each city's water supply system in the event that one tank is out of service for repair.

Based on a preliminary hydraulic design for these lines, the most feasible size for the raw water pipeline, lines A and B is a 12-inch diameter and for lines A1 and A2 is a 6-inch diameter.

Pump Stations

Pump stations required for this system alternative include a raw water pump station and a high service pump station. The system does not require a booster pump station.

The raw water pump station will pump water from the proposed 24-inch diameter lake diversion pipe to the headworks of the treatment plant. This pump station is required because there is insufficient elevation difference between the normal conservation pool level of Lake Bosque (elevation 830) and desirable treatment plant sites to convey water to the plant by gravity. Based on anticipated lake draw down levels (elevation 762) and preferred treatment plant site (elevation 840), the maximum pumping head requirements for this facility will be approximately 85 feet of total head at a flow rate of 1.5 mgd. One possible pump station arrangement for meeting these design conditions consists of a total of four (4) pumps each with a rated capacity of 0.5 mgd (350 gallons per minute) requiring a 10 horsepower motor each. This allows the design conditions to be met with one pumping unit out of service.

A high service pump station will be located at the treatment plant site to pump treated water to Clifton and Meridian. The pumping head requirements are determined by the overflow elevations of the elevated tanks in the cities of Clifton and Meridian and friction loss in the pipeline. The total head requirements to convey the year 2020 average daily demands of Clifton and Meridian (1.29 mgd) is approximately 198 feet. One possible pump station arrangement consists of a total of four (4) pumps each with a rated capacity of 0.43 mgd (300 gpm) requiring a 20 horsepower motor each. This allows for year 2020 conditions to be met with one pump out of service.

Meter Stations

The metering of flow at pump stations is necessary not only for water billing purposes but also for continued monitoring of pump performance and transmission system losses.

It is recommended that for this alternative a meter station be located at the water treatment plant and that flow from each pump be metered. It is also recommended that the system consist of three more meter stations with one located at each of the two connections to the City of Meridian supply system (Lines A1 and A2) and one located at the beginning of Line B near the intersection of S.H. 22 and S.H. 6. This will provide flow data for the total treated water pumpage and consumption by each participant.

Alternative No. 2

Water supply system alternative No. 2 assumes that all cities and water supply corporations in the planning area, with the exception of Hog Creek Water Supply Corporation, utilize Lake Bosque water. The Hog Creek water supply and storage facilities are located in McLennan County and only a small percentage of its customers reside in Bosque County. It is assumed that Hog Creek will seek additional water from McLennan County sources.

Currently only Clifton and Meridian have contracted with BRA for Lake Bosque water in the amount of 2.98 mgd. However, the projected year 2020 average daily demands for these two cities combined is 1.29 mgd. Water supply alternative No. 2 assumes that Clifton and Meridian sell a portion of the remaining firm yield for which they have contracted to other entities in the planning area. This plan will maximize the benefits from Lake Bosque by efficiently utilizing the water and reducing construction, operation and maintenance cost for all participants.

A summary of year 2020 water demand projections and water supplies for this alternative is shown in Table IV-1. This table reflects the conjunctive use of Lake Bosque water to meet average daily demands and existing wells to supply the difference between average and peak day demands.

TABLE IV-1

WATER DEMANDS AND SUPPLY SOURCES
YEAR 2020
ALTERNATIVE 2

CITY OR SUPPLY CORP.	AVERAGE DAILY* DEMANDS (MGD)	PEAK DAY* DEMANDS (MGD)	EXISTING WELL CAPACITIES (MGD)	WATER SUPPLY SOURCE AND AMOUNT (MGD) LAKE BOSQUE	WELLS
Clifton	0.95	2.58	1.54	0.95	1.63
Meridian	0.34	0.92	0.90	0.34	0.58
Valley Mills	0.26	0.70	0.81	0.26	0.44
Iredell	0.09	0.25	0.29	0.09	0.16
Walnut Springs	0.14	0.37	0.34	0.14	0.23
Morgan	0.11	0.29	0.47	0.11	0.18
Cranfills Gap	0.08	0.21	0.10	0.08	0.13
Childress Creek	0.30	0.82	0.76	0.30	0.52
Mustang	0.07	0.17	0.42	0.07	0.10
TOTAL	2.34	6.31	5.63	2.34	3.97

* Demands based on high growth scenario.

As can be seen from this table, the portion of peak day demands to be supplied by existing wells for the year 2020 exceeds the current well capacities for the cities of Clifton and Cranfills Gap. It is anticipated that the differential volume between peak day water demand and well production would be furnished by existing storage facilities in each city.

Alternative No. 2 represents the most comprehensive of the water supply alternatives evaluated. A schematic plan for this alternative is shown on Figure IV-2.

Water Treatment Plant

This alternative involves constructing a water treatment plant with an initial design capacity of 2.5 mgd. This will meet projected average daily demands for year 2000 (1.88 mgd) and year 2020 (2.36 mgd).

On-site storage of treated water would be provided with an operational equal to one day of treatment plant operation (2.5 million gallons).

Pipelines

The pipelines required for this alternative include a 14-inch diameter raw water pipeline from the Lake Bosque outlet pipe to the treatment plant and transmission pipelines to each of the cities and water supply corporations in the planning area.

The raw water pipeline routing involves a line from the raw water pump station to the treatment plant to be installed adjacent to the south dam embankment.

The transmission pipelines shown on Figure IV-2 include a 14-inch main supply pipeline (Lines A and B) to serve entities south and west of Lake Bosque. These entities include Meridian, Clifton, Valley Mills, Childress Creek Water Supply Corporation, Cranfills Gap and Mustang Water Supply Corporation. Pipelines connecting to Lines A and B will serve the individual supply systems. The cities north and east of Lake Bosque including Iredell, Walnut Springs and Morgan will be served by individual transmission pipelines from the treatment plant. The following table indicates the lines required to serve each entity.

TABLE IV-2
TRANSMISSION PIPELINE REQUIREMENTS
ALTERNATIVE NO.2

	PIPELINE DESIGNATION											
City or Supply Corporation	A	A-1	A-2	B	C	D	E	F	G	H	I	J
Clifton	X			X								
Meridian	X	X	X									
Valley Mills	X			X	X							X
Iredell							X					

TABLE IV-2 (CONTINUED)
TRANSMISSION PIPELINE REQUIREMENTS
ALTERNATIVE NO. 2

				PIPELINE DESIGNATION								
City or Supply Corporation	A	A-1	A-2	B	C	D	E	F	G	H	I	J
Walnut Springs						X						
Morgan								X				
Cranfills Gap	X		X						X			
Childress Creek	X			X	X					X		
Mustang	X		X							X		

Pipe sizes for each of these transmission mains shown on Figure IV-2 are based on the ability to convey average daily water demands for each entity as projected for the year 2020.

Each of these pipelines can be installed within existing state highway rights-of-way, with the exception of Line H and a portion of Line E. This will facilitate construction of these lines and eliminate the expense of easement acquisition.

Pump Stations

Pump stations required for this alternative include:

* Raw water pump station
* High service pump station
* Booster pump station, (2)

The raw water pump station will pump lake water from the proposed 24-inch lake diversion pipe to the treatment plant. The design capacity will be the same as that for the treatment plant, 2.5 mgd with a total pumping head requirement of approximately 90 feet. One possible pump station arrangement for meeting these design conditions consists of a total of four (4) pumps each with a rated capacity of 0.83 mgd (580 gpm) requiring a 15 horsepower motor. This provides for a firm capacity of 2.5 mgd with one pump serving as a standby unit.

The high service pump station located at the treatment plant will consist of four (4) separate sets of pumping units due to the different hydraulic design conditions required to serve each entity. However, the individual pumping units can be physically located in the same structure to reduce construction costs. One possible pump arrangement scenario for each pumping unit is shown in the table below.

TABLE IV-3

HIGH SERVICE PUMP STATION
ALTERNATIVE NO. 2

PUMPING UNIT SET NO.	ENTITIES SERVED	YEAR 2020 DESIGN CONDITIONS CAPACITY (MGD)	HEAD REQUIREMENTS (FT)	TOTAL NUMBER OF PUMPS*	MOTOR SIZE PER PUMP (H.P.)
1	Iredell	0.09	355	2	7.5
2	Walnut Springs	0.14	245	2	7.5
3	Morgan	0.11	245	2	7.5
4	Meridian, Clifton, Valley Mills, Cranfills Gap, Childress Creek WSC, Mustang WSC	2.00	215	4	30

* One pump for each pumping unit set serves as standby.

In addition to the high service pump station, two booster pump stations are also needed due to excessive pumping head requirements. One booster station is required to serve the City of Cranfills Gap and Mustang Water Supply Corporation. This station could be located at the present Meridian ground storage site along S.H. 22 just west of Meridian. The year 2020 design capacity of this station is 0.15 mgd requiring a total pumping head of 260 feet. One pump station arrangement scenario to meet these design conditions includes a total of two pumps, one serving as a standby, each rated at 0.15 mgd (105 gpm) and having a 10 horsepower motor.

The second booster pump station is required in Clifton to serve Valley Mills and Childress Creek Water Supply Corporation. The year 2020 design capacity of this station is 0.56 mgd requiring a total pumping head of 210 feet. A pump arrangement scenario to meet these design conditions includes a total of three (3) pumps, one serving as a standby, each rated at 0.28 mgd (195 gpm) and having a 15 horsepower motor.

Meter Stations

Recommended meter station locations for this alternative are shown on Figure IV-2. Flow meter stations are recommended for each of the four (4) sets of high service pumps at the treatment plant site.

In addition, meter stations are recommended at the beginning of Lines A-1, A-2, B, C, G, H, and I. With these meter stations, the amount of treated water transmitted to each entity can be assessed.

Alternative No. 3

Water supply system alternative No. 3 is similar to Alternative No. 1 in that it assumes initially only Clifton and Meridian use Lake Bosque water to supplement existing water well production. However, it involves the initial installation of transmission pipelines sized to convey 100% of the Clifton and Meridian current water rights (2.98 mgd). This represents the largest infrastructure the Cities of Clifton and Meridian may elect to construct initially to meet average daily demands without the participation of another entity. In the event that the other entities in the planning area remain on water wells exclusively, it may be more economically desirable for Clifton and Meridian to install the ultimate line sizes required to utilize their water rights during initial construction.

The water supply system schematic plan for alternative No. 3 is shown on Figure IV-3.

Water Treatment Plant

The recommended initial design capacity of a water treatment plant for Alternative No. 3 is 1.5 mgd. This will meet average daily demands for Clifton and Meridian thru the year 2020. It also will provide additional capacity initially if it is decided to utilize Lake Bosque water to meet periods of greater demand or if well capacities decline.

As part of the treatment plant it is recommended that the equivalent of one day's treatment plant capacity be provided as treated water storage, (1.5 million gallons).

Pipelines

The pipelines required for this alternative include a 16-inch raw water pipeline from the Lake Bosque outlet pipe to the treatment plant, a 16-inch transmission main to Meridian and a 14-inch transmission main from Meridian to Clifton. These sizes are based on conveying the current water rights to Meridian (1.23 mgd) and Clifton (1.75 mgd).

Transmission Lines A and B can be installed in the existing rights-of-way for S.H. 144, S.H. 22 and S.H. 6, thus avoiding the expense of easement acquisition. Transmission Lines A-1 and A-2 will deliver water to City of Meridian storage tanks. Similarly, Lines A-1 and A-2 can be constructed in the existing rights-of-way for S.H. 6 and F.M. 2840. Preliminary hydraulic design of these lines indicates that in order to deliver 100% of Meridian's current water rights, lines A-1 and A-2 need to be 10-inch in diameter.

Pump Stations

Pump stations for Alternative 3 include a raw water pump station and a high service pump station.

The raw water pump station will have an initial pumping head requirement of approximately 70 feet at a flowrate of 1.5 mgd. One possible pump station arrangement for meeting these initial design conditions consists of a total of four (4) pumps each with a rated capacity of 0.5 mgd (350 gpm) requiring a 10 horsepower motor. This allows the design conditions to be met with one pumping unit out of service.

The high service pump station to be located at the treatment plant site will have an initial pumping head requirement of approximately 110 feet to convey year 2020 average daily demands for Clifton and Meridian (1.29 mgd).

One possible pump station arrangement consists of a total of four (4) pumps each with a rated capacity of 0.43 mgd (300 gpm) requiring a 15 horsepower motor each. This allows year 2020 conditions to be met with one pumping unit out of service.

Meter Stations

The recommended meter station locations for this alternative are shown on Figure IV-3. The meter stations include individual pump metering at the high service pump station and metering at the connection points to the City of Meridian water supply system. It is recommended that the meter station for measuring the City of Clifton usage be located at the beginning of line B near the intersection of S.H. 22 and S.H. 6.

Alternative No. 4

Water supply system alternative No. 4 assumes the entities in the planning area that appear to need additional water supplies to meet projected year 2020 peak day demands will utilize Lake Bosque water in conjunction with existing water wells. These entities include Clifton, Meridian, Walnut Springs, Cranfills Gap and Childress Creek WSC.

A summary of year 2020 water demand projections and water supplies for this alternative is shown in Table IV-4. This table reflects the conjunctive use of Lake Bosque water to meet average daily demands and existing wells to supply the difference between average and peak day demands.

TABLE IV-4

WATER DEMANDS AND SUPPLY SOURCES
YEAR 2020
ALTERNATIVE NO. 4

CITY OR SUPPLY CORP.	AVERAGE DAILY* DEMANDS (MGD)	PEAK DAY* DEMANDS (MGD)	EXISTING WELL CAPACITIES (MGD)	WATER SUPPLY SOURCE AND AMOUNT (MGD) LAKE BOSQUE	WELLS
Clifton	0.95	2.58	1.54	0.95	1.63
Meridian	0.34	0.92	0.90	0.34	0.58
Walnut Springs	0.14	0.37	0.34	0.14	0.23
Cranfills Gap	0.08	0.21	0.10	0.08	0.13
Childress Creek	0.30	0.82	0.76	0.30	0.52
TOTAL	1.81	4.90	3.64	1.81	3.09

* Demands based on high growth scenario.

This table shows the portion of peak day demands to be met by existing wells exceeds exceeding current well capacities slightly for Clifton and Cranfills Gap. Again as previously discussed, the differential can be supplied by existing storage facilities.

A schematic plan for this supply system alternative is shown on Figure IV-4.

Water Treatment Plant

This alternative involves constructing a water treatment plant with a design capacity of 2.0 mgd. This will meet projected average daily demands for year 2000 (1.42 mgd) and year 2020 (1.81 mgd).

On-site storage of treated water will be provided with a volume equal to one day of treatment plant operation (2.0 million gallons).

Pipelines

The pipelines required for this alternative include a 14" raw water pipeline from the Lake Bosque outlet pipe to the treatment plant and transmission pipelines to each of the entities identified for this alternative.

The raw water pipeline will extend from the raw pump station to the treatment plant south of the proposed dam.

The transmission pipelines shown on Figure IV-4 include a 14" main supply line (Lines A and B) to serve entities south of Lake Bosque. These entities include Meridian, Clifton, Cranfills Gap and Childress Creek WSC. Pipelines connecting to Lines A and B will serve individual supply systems. Walnut Springs will be served by a separate single transmission line routed directly from the treatment plant. The pipeline sizes shown on Figure IV-4 reflect those required to convey year 2020 average daily demands. The following table indicates the lines required to serve each entity.

TABLE IV-5

TRANSMISSION PIPELINE REQUIREMENTS
ALTERNATIVE NO. 4

CITY OR SUPPLY CORPORATION	PIPELINE DESIGNATION							
	A	A1	A2	B	C	D	G	H
Clifton	X			X				
Meridian	X	X	X					
Walnut Springs						X		
Cranfills Gap	X		X				X	
Childress Creek WSC	X			X	X	X		

All of these pipelines, with the exception of line H, can be installed within existing state highway rights-of-way. This will facilitate construction of these lines and eliminate the expense of easement acquisition.

Pump Stations

The pump stations required for this alternative include:

* Raw water pump station
* High service pump station
* Booster pump stations, two (2)

The raw water pump station will pump water from the proposed 24" lake outlet pipe to the treatment plant headworks. The preliminary design capacity will be the same as that for the treatment plant, 2.0 mgd, with a total pumping head requirement of approximately 80 feet. One possible pump station arrangement for meeting these design conditions consists of a total of four (4) pumps each with a rated capacity of 0.67 mgd (460 gpm) requiring a 15 horsepower motor. This provides for a firm capacity of 2.0 mgd with one pump serving as a standby unit.

The high service pumping facilities located at the treatment plant will consist of two (2) separate sets of pumping units due to different hydraulic design conditions required to serve each entity. The separate units, however, can be located within the same structure to reduce construction costs. One possible pump arrangement for the two pumping units is shown in Table IV-6.

TABLE IV-6

HIGH SERVICE PUMP STATION
ALTERNATIVE NO. 4

		YEAR 2020 DESIGN CONDITIONS			
PUMPING UNIT SET NO.	ENTITIES SERVED	CAPACITY (MGD)	HEAD REQUIREMENTS (FT)	TOTAL NUMBER OF PUMPS*	MOTOR SIZE PER PUMP (H.P.)
1	Walnut Springs	0.14	245	2	7.5
2	Meridian, Clifton, Cranfills Gap, and Childress Creek WSC	1.67	157	4	20

* One pump for each pumping unit set serves as a standby.

In addition to the high service pump station, this alternative requires two (2) booster pump stations due to excessive head requirements. One possible pump arrangement for the booster pump stations is shown on Table IV-7.

TABLE IV-7

BOOSTER PUMP STATIONS
ALTERNATIVE NO. 4

PUMPING UNIT SET NO.	ENTITIES SERVED	YEAR 2020 DESIGN CONDITIONS CAPACITY (MGD)	HEAD REQUIREMENTS (FT)	TOTAL NUMBER OF PUMPS*	MOTOR SIZE PER PUMP (H.P.)
1	Childress Creek WSC	0.30	125	2	10
2	Cranfills Gap	0.08	245	2	5

The high service pump station and the two booster pump stations were analyzed in the preceding tables based on year 2020 demands for only the entities anticipated to utilize Lake Bosque under this alternative. However, additional entities may desire to be included as participants at some point in the future. Therefore, it is recommended that during final design of these facilities, pumping units be considered that can meet both initial as well as possible future head requirements efficiently. One common method of achieving this is by changing pump impellers when head requirements dictate.

Meter Stations

The recommended meter station locations for this alternative are shown on Figure IV-4. Flow meter stations are recommended for each of the two (2) sets of high service pumps at the treatment plant site.

Meter stations are also recommended at the beginning of lines AI, A2, B, C, and G.

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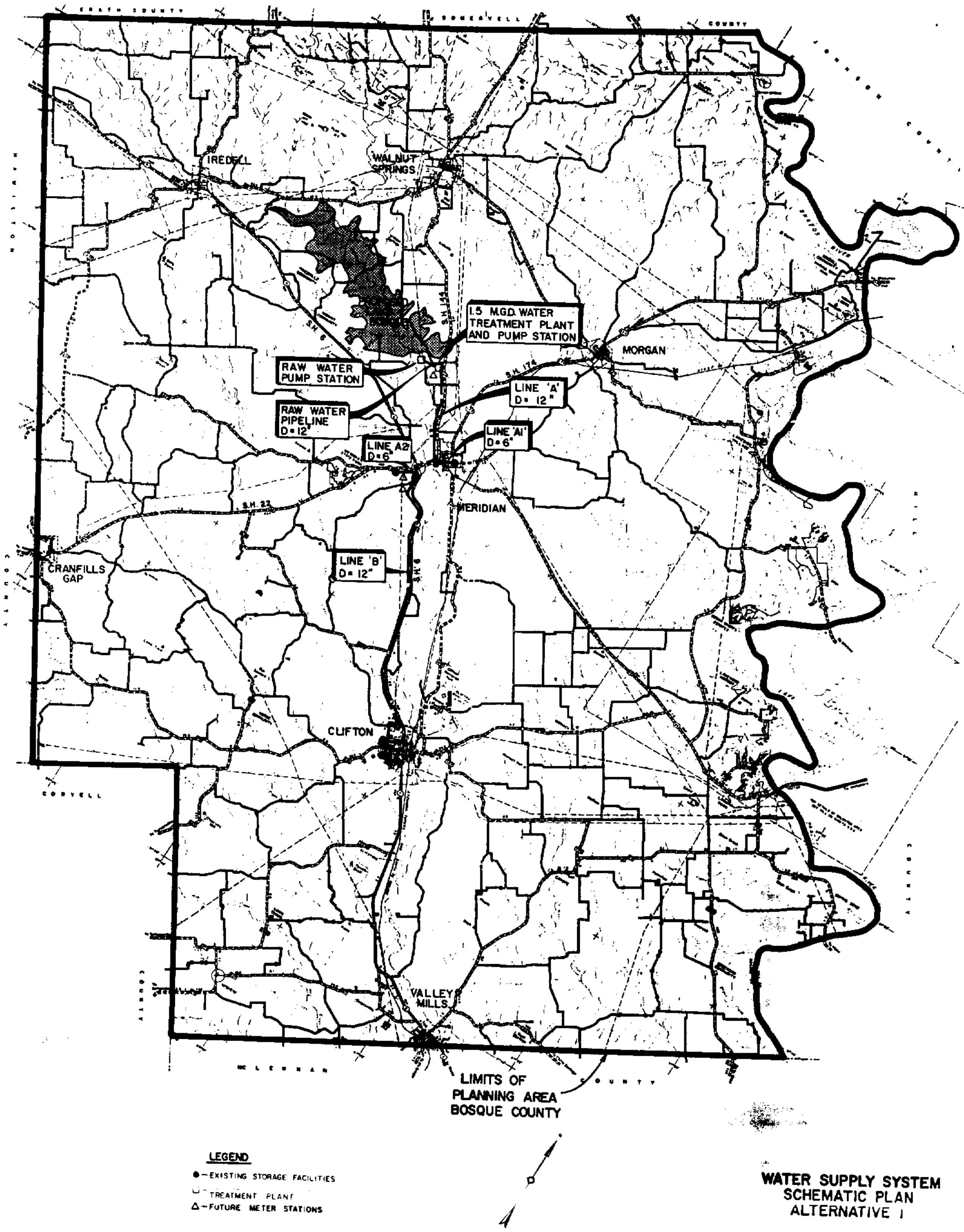
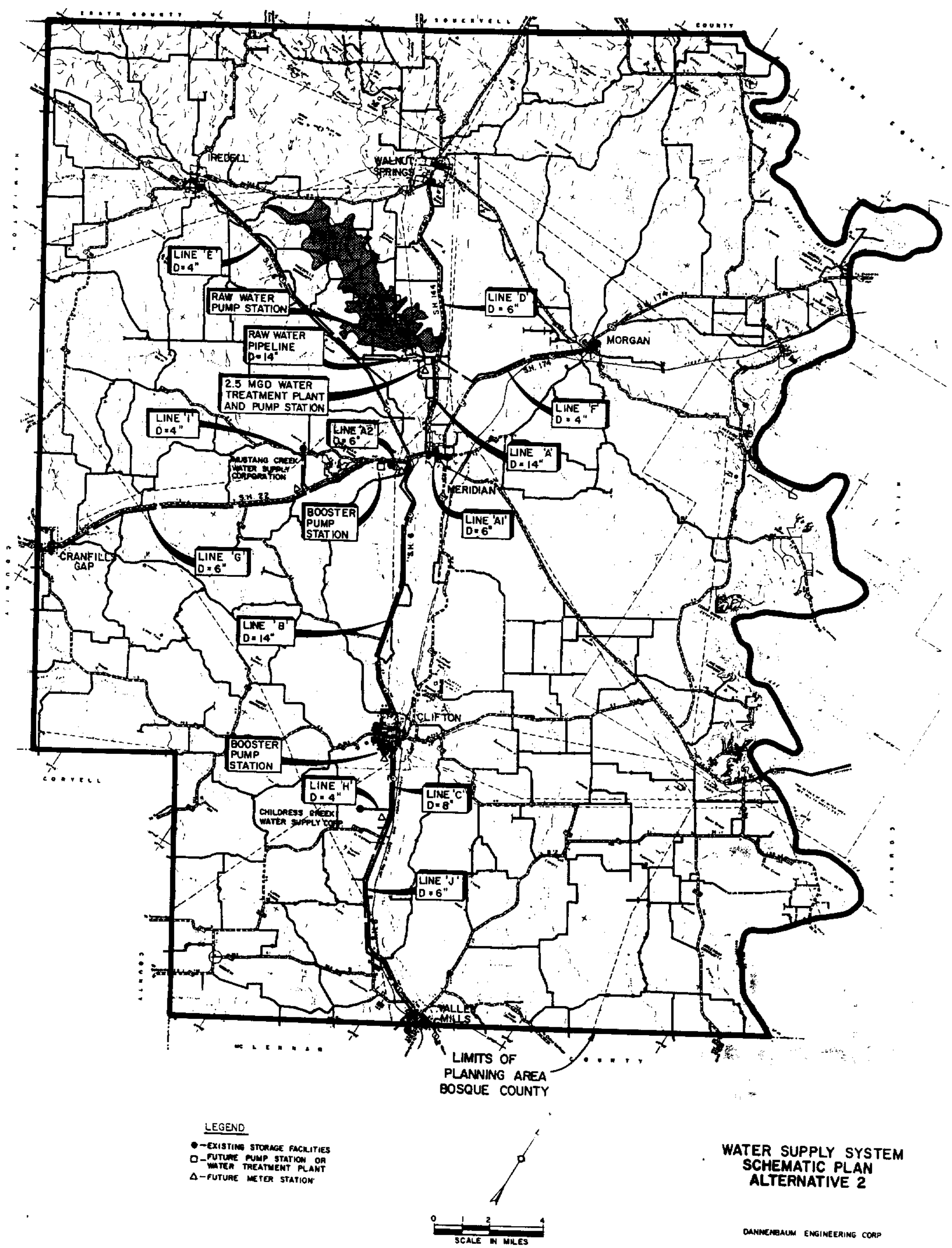


WATER SUPPLY SYSTEM
SCHEMATIC PLAN
ALTERNATIVE I

DANNENBAUM ENGINEERING CORP.

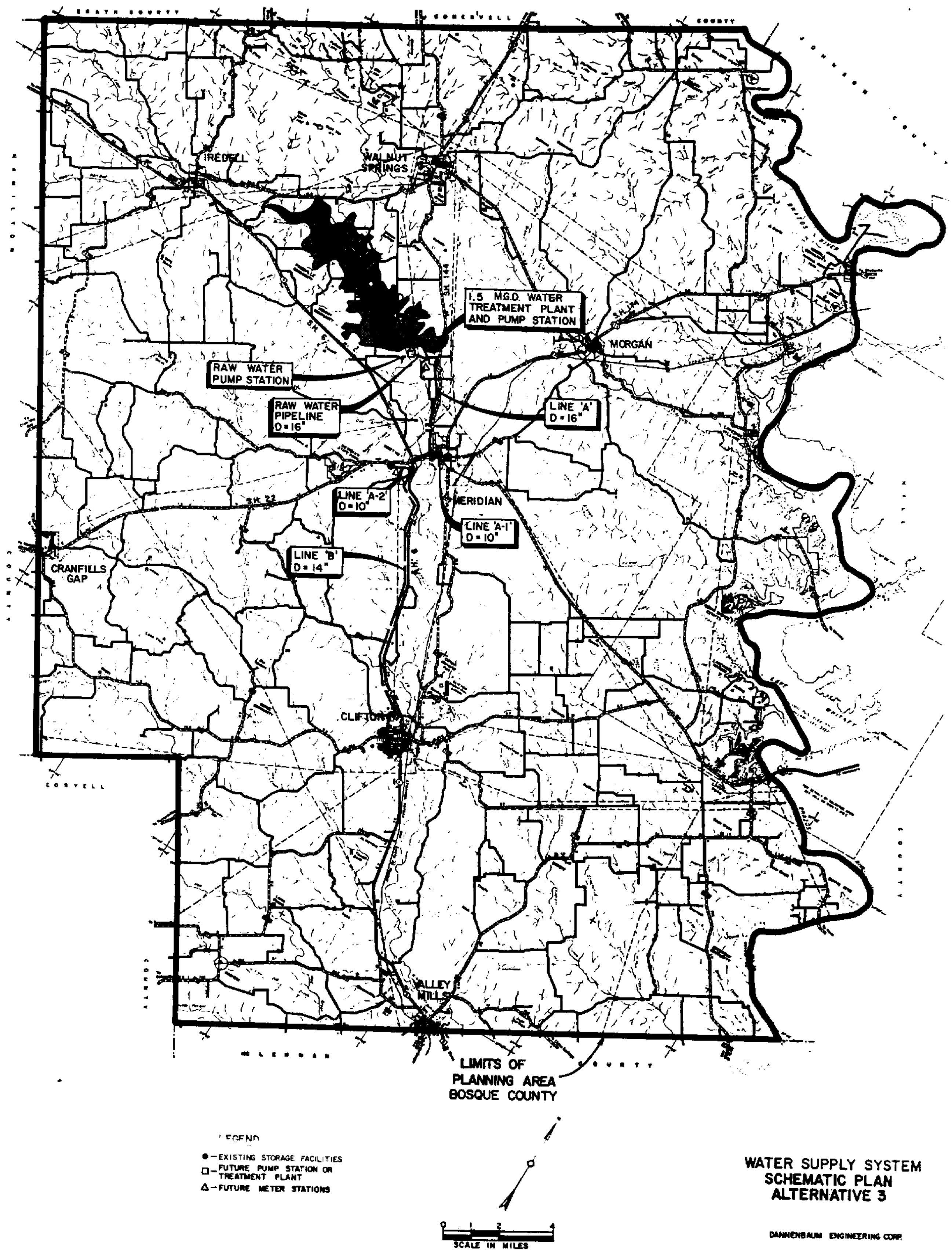
FIGURE IV-1



WATER SUPPLY SYSTEM SCHEMATIC PLAN ALTERNATIVE 2

DANNENBAUM ENGINEERING CORP

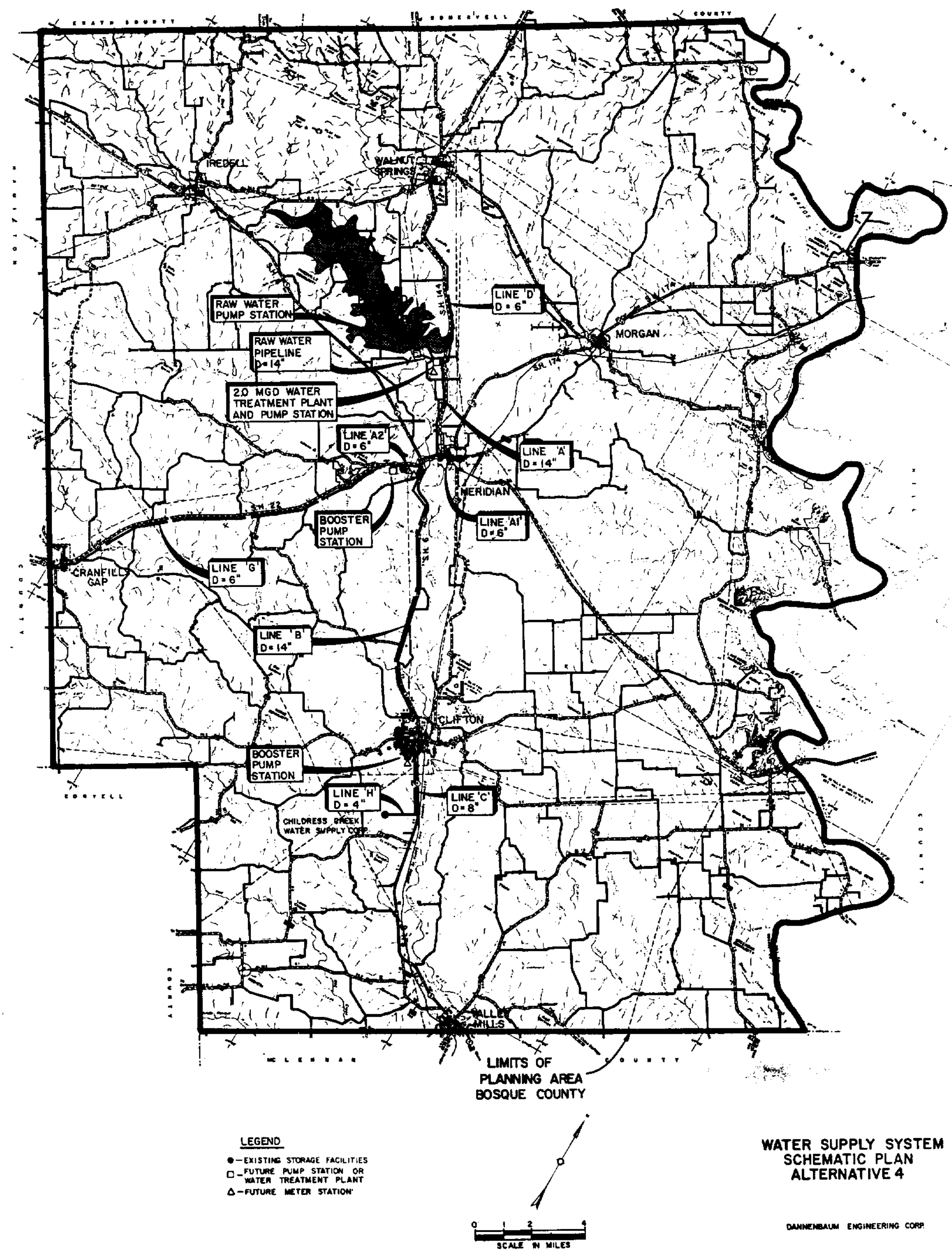
FIGURE IV - 2



WATER SUPPLY SYSTEM
SCHEMATIC PLAN
ALTERNATIVE 3

DANNENBAUM ENGINEERING CORP.

FIGURE IV - 3



WATER SUPPLY SYSTEM
SCHEMATIC PLAN
ALTERNATIVE 4

DANNENBAUM ENGINEERING CORP.

FIGURE IV-4

Section V
Major Facilities

SECTION V

MAJOR FACILITY SITES

The primary facilities associated with the utilization of Lake Bosque to supplement water wells include a water treatment plan, a raw water pump station and booster pump station(s). The general locations of these facilities for the various alternatives have been presented based on preliminary hydraulic design considerations. Several other factors that are important in the selection of sites for these facilities can be categorized as operational and construction considerations.

Operational and construction considerations include those site characteristics affecting the constructability and the ongoing operation and maintenance requirements of the facilities. Site suitability in regards to operational and construction considerations can have a significant impact on both capital and operational cost, particularly for a water treatment plant.

These considerations include the following:

* Area requirements
* Topography
* Geological conditions
* Power availability
* Site accessibility

A. Water Treatment Plant

The current water rights for which the Bosque County participants (Clifton and Meridian) have contracted with the Brazos River Authority (BRA) is 2.98 mgd. For purposes of this study, the ultimate treatment plant capacity is considered to be 3.0 million gallons per day (mgd).

The treatment plant site, therefore, must have sufficient area for the construction and operation of a 3.0 mgd facility. In establishing the area requirements, it is assumed the facility will consist of the following conventional processes:

* Coagulation
* Flocculation
* Clarification
* Filtration

Although water quality assessment is beyond the scope of this study, it is assumed that future Lake Bosque water will be similar in quality to Lake Waco water. In particular, it is not anticipated that de-salanization processes such as reverse osmosis will required. However, a complete water quality assessment will be required prior to final design of the plant.

The maximum space requirements for sludge processing are those required for sludge lagoons as opposed to mechanical dewatering. Therefore, in order to be conservative it is assumed that lagooning operations will be employed.

In order to maintain more constant plant operation and to meet periods of peak demands more efficiently, it is desirable to provide adequate clear-well storage of treated water. It is recommended that storage volume equal one day's plant operation (3.0 million gallons).

A conceptual site plan for the Lake Bosque Water Treatment Plant is shown on Figure V-1. This layout represents area requirements for two identical 1.5 mgd plants. Sufficient space is provided for initial construction of one 1.5 mgd plant and future construction of an identical second phase. Based on this arrangement a minimum of 7 acres is required. However, it is recommended that a 10 acre site be purchased to allow for additional future expansion needs.

The desired topography for a conventional water treatment plant consists of a gently sloping terrain compatible with the layout of a hydraulically efficient treatment plant. A plant with high-rate gravity filters typically results in 13 to 23 feet of headloss through the plant. The site should not be located adjacent to major drainage ways where facilities may be subject to flooding by the 100-year frequency flood. A plant located within a flood plain will require a costly flood protection system.

The geological requirements for the site can be classified as foundation and construction requirements. The soil characteristics should provide adequate foundation support for each treatment structure without the use of extensive structural support measures such as drilled piers. It is desirable that the soil not be highly compressible or exhibit a potential for excessive shrink/swell activity. For construction purposes, the soil should allow reasonable excavation slopes and not require extensive excavation shoring systems. Additionally, the site should not contain extensive rock outcroppings that would make excavation difficult and costly.

Power availability is also important to site location. It is desirable to provide a dual-service power source to ensure treatment plant reliability. Power requirements for a 3.0 mgd the treatment plant and high service pump station will typically require 230-460 volt, 3 phase primary power.

The site should be accessible from an all-weather, well maintained road that is capable of carrying maintenance, chemical and construction vehicles. For a plant this size, rail service does not typically offer a significant savings in chemical delivery cost. Therefore, rail services is not considered a requirement for the Lake Bosque treatment plant.

The above site criteria were used to identify and evaluate potential sites. A site that meets these requirements is located adjacent to the west right-of-way of State Highway 144 and just south of the proposed Lake Bosque embankment. The recommended treatment plant site is shown on Figure V-2.

This site offers sufficient area for the construction and operation of a treatment plant with an ultimate capacity of 3.0 mgd. The topography of the site is gently sloping with adequate relief for construction of a hydraulically efficient treatment plant.

The site does not contain any area in the 100-year frequency flood and will not require costly on site drainage improvements.

The geological conditions of the site consist of surface soils composed of clay and underlying limestone bedrock at a depth of 3 to 6 feet. These conditions offer desirable excavation and slope stabilization requirements as well as structural support for treatment plant structures.

The site is in a dual power service area served by Texas-New Mexico Power and Erath County Electric Cooperative. There are existing transmission and distribution lines near the site. Extending service to the site by either or both of these utilities can be feasibly done.

This site location also offers good access directly from State Highway 144. Minimal cost will be associated with providing dependable, all-weather access to the site during both construction and operation of the plant facilities.

B. Raw Water Pump Station

The proposed Lake Bosque Project being developed by BRA includes plans for a combined intake and outlet structure just downstream of the dam. In a report prepared for BRA in 1988 entitled "Lake Bosque Intake Alternatives for the Cities of Clifton and Meridian, Texas", preliminary design indicates the need for a 24-inch outlet pipe to deliver the water rights of the Bosque County participants. This pipe will extend from the intake structure, under the dam to a point approximately 400 feet downstream of the dam.

The recommended raw water pump station site is to be located at that point adjacent to the proposed stilling basin and will require approximately 0.4 acres. It is desirable that the elevation of the site be of such an elevation to take advantage of the available suction head from static lake levels. The key design elevations of Lake Bosque are projected as follows:

* Normal Pool Elevation - 830 Ft. MSL
* 100-Year Flood Elevation - 842 Ft. MSL
* Low Flow Elevation - 762 Ft. MSL

As with the recommended treatment plant site, it is desirable that the raw water pump station be located above the 100-year frequency flood elevation downstream of the dam, which is projected to be elevation 771. The top of the stilling basin wall is projected to be at elevation 775. Therefore, it is recommended that the pump station be located at or above elevation 778 to avoid the need for costly flood protection measures.

Power requirements and availability for the raw water pump station are similar to those for the treatment plant. It is desirable to provide a dual-service power source to ensure a reliable raw water supply to the treatment plant.

Dependable access to the pump station for construction and operation purposes is important. The routing of an access road from the dam to the pump station site should be coordinated with final design and construction of the Lake Bosque Project.

The recommended location for the raw water pump station is shown on Figure V-2.

C. Booster Pump Stations

The most important criteria for booster pump station site selection is hydraulic design requirements. As previously discussed in Section IV of this report, a booster pump station is required to supply Lake Bosque water to Cranfills Gap and Mustang Water Supply Corporation. A second booster pump station is required to supply Lake Bosque water to Valley Mills and Childress Creek Water Supply Corporation. The recommended location for each of these sites is shown on Figures IV-2 and IV-4.

Each of these sites will require approximately 0.3 acres of land and should be located above the 100-year frequency flood elevation.

The proposed booster pump station site to serve Cranfills Gap and Mustang WSC should be located near the existing City of Meridian ground storage tank located approximately 2500 ft. west of the intersection of State Highways 22 and 6. This site offers good power availability and site access via S.H. 22.

The proposed booster pump station site to serve Valley Mills and Childress Creek WSC should be located near the two 200,000 gallon ground storage tanks on the west side of Clifton. The exact location is subject to site availability since these tanks are near heavily developed neighborhoods. A booster pump station in this general area offers good access by existing City of Clifton streets. Power service can also be extended to the site feasibly from existing lines in the area.

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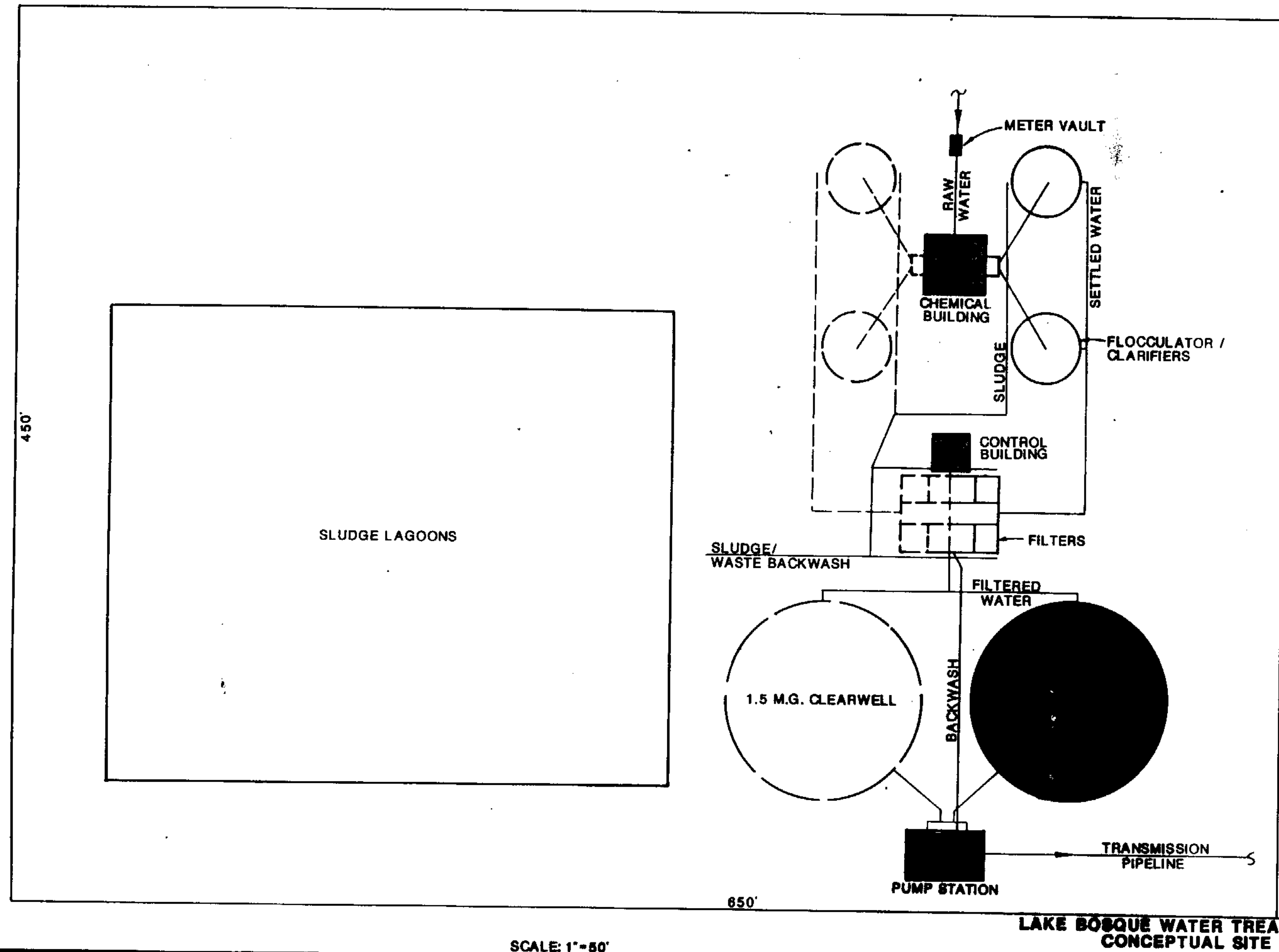
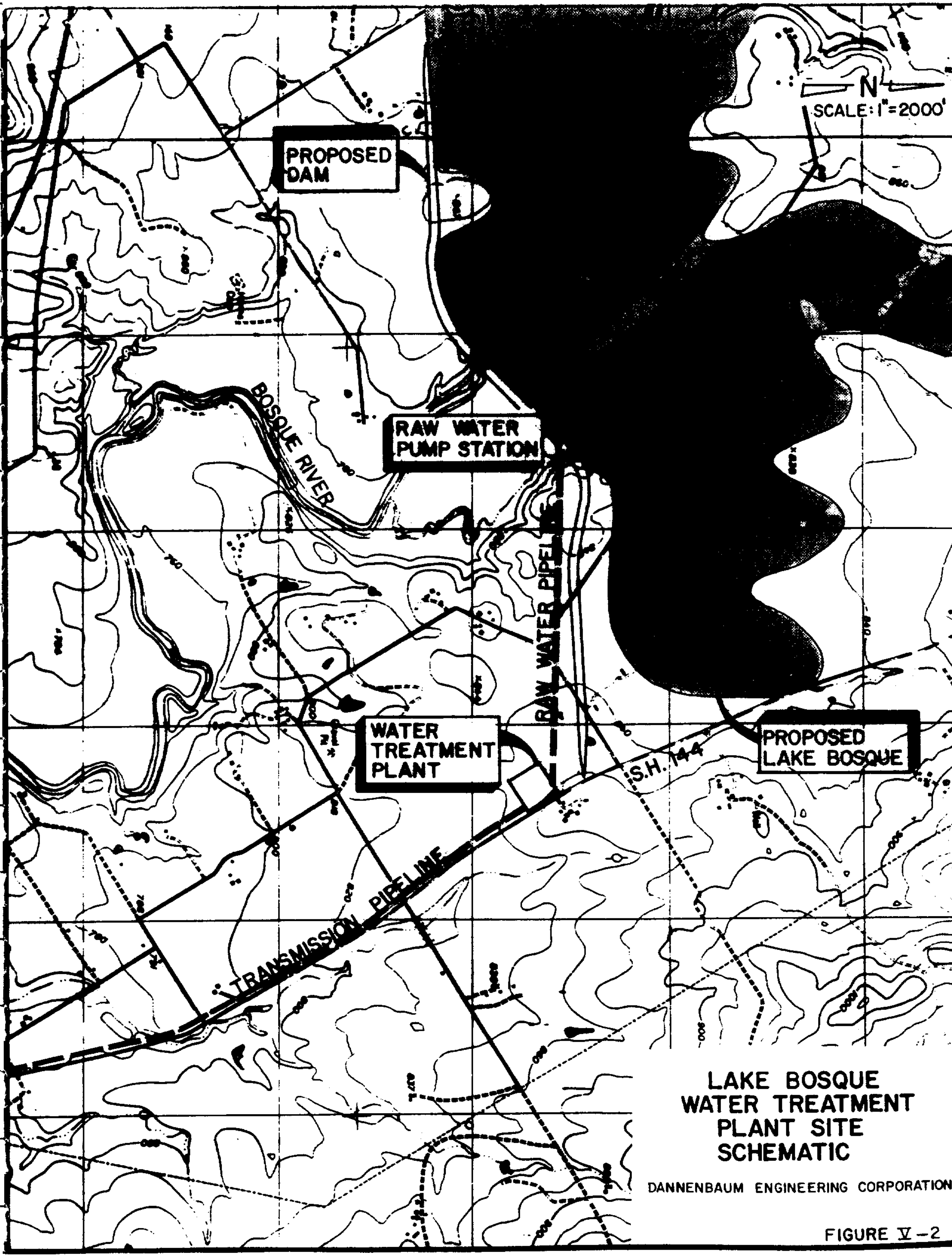


LAKE BOSQUE WATER TREATMENT PLANT
CONCEPTUAL SITE PLAN
FIGURE V-1



LAKE BOSQUE
WATER TREATMENT
PLANT SITE
SCHEMATIC

DANNENBAUM ENGINEERING CORPORATION

FIGURE V-2

Section VI
Water Supply System Cost Estimates

SECTION VI

WATER SUPPLY SYSTEM
COST ESTIMATES

One objective of this study is to develop cost estimates to quantitatively evaluate the four water supply system alternatives. The water supply system costs include the following components:

* Lake Bosque Water Cost
* Capital Cost
* Plant Management Cost
* Operation and Maintenance Cost
* Chemical and Energy Cost

The cost estimates were prepared using a variety of sources including Brazos River Authority (BRA) reports, construction costs of similar projects; conservations with contractors, Brazos River Authority staff and City of Meridian and Waco staff.

A. Lake Bosque Water Cost

The projected firm yield of Lake Bosque as determined by BRA is 15.98 mgd. The amount of this yield that has been contracted for by the Bosque County participants (cities of Clifton and Meridian) is 18.63%, or 2.98 mgd. This represents the proportion of the Lake Bosque Project cost that must be paid for by the Bosque County participants.

The proposed Lake Bosque Project will consist of a dam, combination intake and outlet structure and two diversion pipes extending under the dam. A 24" diversion pipe will be installed to divert the Bosque County participant's water rights.

The construction, operation and maintenance of these facilities will be performed by BRA. Under the original current use water agreement the estimated annual payment on this debt services is composed of the following:

Construction Cost		$4,689,700.00
Operation and Maintenance Cost		300,000.00
	TOTAL	$4,989,700.00

The proportionate annual payment for Bosque County participants is 18.63% of this amount, or $929,581.11

The cities of Clifton and Meridian have contracted for the following amount of the Bosque County participant's share:

Clifton	- 58.62% of 2.98 mgd = 1.75 mgd
Meridian	- 41.38% of 2.98 mgd = 1.23 mgd

The proportionate annual payment for Clifton and Meridian based on these percentages are shown in Table IV-1.

TABLE VI-1

LAKE BOSQUE WATER COST
ORIGINAL CONTRACT

BOSQUE COUNTY PARTICIPANT	CONSTRUCTION COST ANNUAL PAYMENT	CONSTRUCTION COST PAYMENT TERM	O&M COSTS ANNUAL PAYMENT	O&M COSTS PAYMENT TERM	TOTAL ANNUAL PAYMENT
Clifton	$512,157.73	1990-2019	$32,762.72	1992 - ON	$544,920.45
Meridian	$361,533.38	1990-2019	23,127.28	1992 - ON	$384,660.66

The above figures represent the annual payments required of Clifton and Meridian if no other entities choose to utilize Lake Bosque water. However, if other Bosque County entities purchase water from Clifton and Meridian, the proportionate water service debt for each participant can be determined based on year 2020 average daily demands for those entities. An example of how the water service debt might be apportioned is outlined in the following example.

Example: - Alternative No. 2

WATER COST APPORTIOMENT FOR (YEAR 2020 DEMANDS)	
ANNUAL PAYMENT FOR LAKE BOSQUE	$929,581
AMOUNT OF AVAILABLE WATER (MGD)	2.98
COST OF WATER PER MGD	$311,900/mgd

	ADD (MGD)	WATER COST	STORAGE COST	TOTAL COST WATER/STORAGE	PERCENTAGE TOTAL COST
Clifton	0.95	$296,343	$81,051	$377,394	40.60%
Meridian	0.34	106,060	29,008	135,067	14.53%
Valley Mills	0.26	81,104	22,182	103,287	11.11%
Iredell	0.09	28,075	7,679	35,753	3.85%
Walnut Springs	0.14	43,672	11,944	55,616	5.98%
Morgan	0.11	34,313	9,385	43,698	4.70%
Cranfills Gap	0.08	24,955	6,825	31,781	3.42%
Childress Creek WSC	0.30	93,582	25,595	119,177	12.82%
Mustang Creek	0.07	21,836	5,972	27,808	2.99%
	2.34	$729,939	$199,642	$929,581	100%
Remaining Cost		($199,642)			

A summary of water debt percentages for each entity for the four (4) alternatives is shown on Table VI-2.

TABLE VI-2

RAW WATER COST
PROPORTIONATE COST PERCENTAGES

ALTERNATIVE NO.	ENTITY	PROPORTIONATE COST
1	Clifton	59%
	Meridian	41%
2	Clifton	40%
	Meridian	15%
	Valley Mills	11%
	Iredell	4%
	Walnut Springs	6%
	Morgan	5%
	Cranfills Gap	3%
	Childress Creek WSC	13%
	Mustang WSC	3%
3	Clifton	59%
	Meridian	41%
4	Clifton	52%
	Meridian	19%
	Walnut Springs	8%
	Cranfills Gap	4%
	Childress Creek WSC	17%

B. Capital Cost

The capital cost estimate for the water supply system consists of the following primary components:

* Raw water supply system
* Water treatment plant
* Transmission system

Capital cost estimates are based on 1989 dollars and include construction cost and estimated engineering costs.

Raw Water Supply System

The raw water supply system is composed of the raw water pump station and the raw water pipeline from the pump station to the water treatment plant. Raw water supply system capital cost estimates for each alternatives are shown in Table VI-3.

TABLE VI-3
RAW WATER SUPPLY SYSTEM
COST ESTIMATE

Alternative No.	Raw Water Pump Station	Raw Water Pipeline	Engineering & Contingency (20%)	Total
1	250,000	105,000	70,000	$426,000
2	325,000	105,000	86,000	$516,000
3	250,000	175,000	85,000	$510,000
4	285,000	105,000	78,000	$468,000

An itemized cost estimate for each alternative is shown in Appendix A.

The proportionate raw water supply system cost for each participant is based on year 2020 average daily demand projections. A summary of proportionate cost percentages for each alternative is shown on Table VI-4.

TABLE VI-4

RAW WATER SUPPLY SYSTEM
PROPORTIONATE COST PERCENTAGES

ALTERNATIVE NO.	ENTITY	PROPORTIONATE COST
1	Clifton	74%
2	Meridian	26%
2	Clifton	40%
	Meridian	15%
	Valley Mills	12%
	Iredell	4%
	Walnut Springs	6%
	Morgan	4%
	Cranfills Gap	3%
	Childress Creek WSC	13%
	Mustang WSC	3%
3	Clifton	74%
	Meridian	26%
4	Clifton	52%
	Meridian	19%
	Walnut Springs	8%
	Cranfills Gap	4%
	Childress Creek WSC	17%

Water Treatment Plant

The water treatment plant construction cost includes the cost of treatment facilities, high service pump station and treated water storage. Water treatment plant construction costs for each alternative are shown below.

TABLE VI-5
WATER TREATMENT PLANT
COST ESTIMATE

Alternative No.	Water Treatment Plant Cost	Engineering & Contingency (20%)	Total
1	$1,800,000	$ 360,000	$ 2,160,000
2	2,950,000	590,000	3,540,000
3	1,800,000	360,000	2,160,000
4	2,450,000	490,000	2,940,000

An itemized cost estimate for each alternative is included in Appendix A.

The proportionate water treatment plant cost for each participant is based on year 2020 average daily demand projections. A summary of proportionate cost percentages for each alternative is shown on Table VI-6.

TABLE VI-6

WATER TREATMENT PLANT
PROPORTIONATE COST PERCENTAGES

ALTERNATIVE NO.	ENTITY	PROPORTIONATE COST
1	Clifton	74%
	Meridian	26%
2	Clifton	40%
	Meridian	15%
	Valley Mills	12%
	Iredell	4%
	Walnut Springs	6%
	Morgan	4%
	Cranfills Gap	3%
	Childress Creek WSC	13%
	Mustang WSC	3%
3	Clifton	74%
	Meridian	26%
4	Clifton	52%
	Meridian	19%
	Walnut Springs	8%
	Cranfills Gap	4%
	Childress Creek WSC	17%

Transmission System

Construction cost estimates for the transmission system include pipelines, valves, meter stations and booster pump stations. Cost estimates for each alternative are shown in Table VI-7. An itemized estimate for each alternative is shown in Appendix B.

TABLE VI-7
TRANSMISSION SYSTEM COST

Alternative No.	Pipeline	Construction Cost	Engineering & Contingency (20%)	Total
1	A	$ 409,300	$ 81,860	$ 491,160
	A-1	108,000	21,600	129,600
	A-2	46,000	9,200	55,200
	B	1,094,300	218,860	1,313,160
		ALTERNATIVE NO. 1 TOTAL		$1,989,120
2	A	522,200	104,400	626,640
	A-1	108,000	21,600	129,600
	A-2	46,000	9,200	55,200
	B	1,410,900	282,180	1,693,080
	C	409,600	81,920	491,520
	D	425,000	85,000	510,000
	E	521,900	104,380	626,280
	F	294,500	58,900	353,400
	G	887,000	177,400	1,064,400
	H	68,400	13,680	82,080
	I	116,500	23,300	139,800
	J	511,000	102,200	613,200
		ALTERNATIVE NO. 2 TOTAL		$6,385,200
3	A	672,700	134,540	807,240
	A-1	140,800	28,160	168,960
	A-2	56,400	11,280	67,680
	B	1,407,300	281,460	1,688,760
		ALTERNATIVE NO. 3 TOTAL		$2,732,640
4	A	522,200	104,400	626,640
	A-1	108,000	21,600	129,600
	A-2	46,000	9,200	55,200
	B	1,410,900	282,180	1,693,080
	C	409,600	81,920	491,520
	D	425,000	85,000	510,000
	G	887,000	177,400	1,064,400
	H	68,400	13,680	82,080
		ALTERNATIVE NO. 4 TOTAL		$4,652,520

The proportionate transmission system cost for each participant is based on year 2020 average daily demand projections. Each entity will pay for the proportion of transmission pipelines required to convey Lake Bosque water to that entity's water supply system. A summary of proportionate cost percentages for each alternative is shown on Table VI-8.

TABLE VI-8

**TRANSMISSION SYSTEM
PROPORTIONATE COST PERCENTAGES**

Alt. No.	Entity	A	A-1	A-2	B	C	D	E	F	G	H	I	J
1	Clifton	74			100								
	Meridian	26	100	100									
2	Clifton	47			61								
	Meridian	17	100	71									
	Valley Mills	14			19	49							100
	Iredell							100					
	Walnut Springs						100						
	Morgan								100				
	Cranfills Gap	4		16						100			
	Childress Creek WSC	15			20	51					100		
	Mustang WSC	3		13								100	
3	Clifton	74			100								
	Meridian	26	100	100									
4	Clifton	57			76								
	Meridian	20	100	100									
	Walnut Springs						100						
	Cranfills Gap	5								100			
	Childress Creek WSC	18			24	100					100		

Capital Cost Summary

Water supply system capital cost for each participant based on the proportionate percentages and cost estimates previously presented are shown on Table VI-9. These cost estimates include construction, engineering and surveying cost in 1989 dollars.

TABLE VI-9

WATER SUPPLY SYSTEM
CAPITAL COST ESTIMATE SUMMARY

Alt. No.	Entity	Raw Water Supply	W.T.P.	Transmission	Total
1	Clifton	315,240	1,598,400	1,676,618	3,590,258
	Meridian	110,760	561,600	312,502	984,862
		426,000	2,160,000	1,989,120	4,575,120
2	Clifton	206,400	1,416,000	1,327,300	2,949,700
	Meridian	77,400	531,000	275,320	883,720
	Valley Mills	61,920	424,800	1,263,460	1,750,180
	Iredell	20,640	141,600	626,280	788,520
	Walnut Springs	30,960	212,400	510,000	753,360
	Morgan	20,640	141,600	353,400	515,640
	Cranfills Gap	15,480	106,200	1,098,298	1,219,978
	Childress Creek WSC	67,080	460,200	765,367	1,292,647
	Mustang WSC	15,480	106,200	165,775	287,455
		516,000	3,540,000	6,385,200	10,441,200
3	Clifton	377,400	1,598,400	2,286,118	4,261,918
	Meridian	132,600	561,600	446,522	1,140,722
		510,000	2,160,000	2,732,640	5,402,640
4	Clifton	243,360	1,528,800	1,643,926	3,416,086
	Meridian	88,920	558,600	310,128	957,648
	Walnut Springs	37,440	235,200	510,000	782,640
	Cranfills Gap	18,720	117,600	1,095,732	1,232,052
	Childress Creek WSC	79,560	499,800	1,092,734	1,672,094
		468,000	2,940,000	4,652,520	8,060,520

C. Plant Management Cost

Plant management cost represents the ongoing annual cost to employ personnel to manage treatment plant operations. This cost is not anticipated to differ between the various alternatives analyzed. It is assumed the cost to manage a 1.5 mgd plant is essentially the same as the cost to manage a 3.0 mgd plant. However, the plant management cost may vary depending on the management alternative selected (i.e. BRA vs. a water district).

The estimated annual plant management cost is shown below:

Full-time plant manager	$48,000
Part-time assistant plant manager	20,000
Secretary	20,000
	$88,000/year

The proportionate plant management annual cost for each participant is based on the same percentages used to determine proportionate water treatment plant cost.

D. Operation and Maintenance Cost

Water Treatment Plant

The operation and maintenance cost for the water treatment plant includes O&M personnel cost and equipment required to maintain the plant facilities.

1. Operation Cost

Plant Operation	$32,000
Laboratory Technician	28,000
	$60,000/year

2. Maintenance

Maintenance personnel	$14,000
Vehicles and equipment	30,000
	$44,000/year

It should be noted that these cost do not include replacement cost for major equipment.

The proportionate plant O&M annual cost for each participant is based on the same percentages used to determine proportionate water treatment plant cost.

Water Wells

The operation and maintenance cost for the existing well systems in the planning area must also be considered. The estimated cost for each entity to maintain current wells is $2400 per year.

E. Chemical and Energy Cost

Water Treatment Plant

A water quality assessment of proposed Lake Bosque is beyond the scope of this study. It is assumed, however, that Lake Bosque water quality parameters will be similar to Lake Waco.

It is anticipated that treatment of Lake Bosque water will require similar chemicals and dosages as those employed by the City of Waco to treat Lake Waco water. The estimated chemical cost for treating Lake Bosque water is $0.04/1000 gallons.

The energy cost for plant operation and delivering treated water to the customer from the treatment plant are based on the current Texas-New Mexico Power rate for municipal customers of $0.04/kilowatt- hour.

Treatment plant energy cost	$0.04/1000 gallons
Transmission energy cost	$0.05/1000 gallons

The cost of pumping raw water to the headworks of the water treatment plant is included as part of transmission energy cost.

Water Wells

The energy cost of pumping well water to the surface was established by analyzing available records for entities in the planning area. The rate fluctuates during an annual period but the average annual energy cost is approximately $0.24/1000 gallons.

The water quality of existing wells in the planning area is such that only chlorine is required for disinfection purposes. The chemical cost for treating well water is approximately $0.01/1000 gallons.

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Section VII
Implementation and Utilization Plan

SECTION VII

IMPLEMENTATION AND UTILIZATION PLAN

A. Deliverable Cost of Water

The water supply systems alternatives presented in this study represent a range of entities that may choose to utilize Lake Bosque water. Each alternative assumes a conjunctive use of surface water to supplement existing groundwater wells. The deliverable cost of water for each alternative, therefore, represents the cost of supplying both treated surface water and groundwater from existing wells to each entity. The components of this total cost can be separated as:

* Fixed cost
* Water Treatment Plant Variable Cost
* Well Variable Cost

Fixed cost represents those expenses which remain constant over the length of a specified period. These include the debt service on the treatment plant, the lake facilities (water debt), the raw water supply system and the transmission system. The annual debt payment for capital expenditures is based on an annual interstate rate of 8.0% and a bonding period of 30 years.

The annual cost for plant management and maintenance are also considered to be fixed cost in that they do not vary significantly with different operation scenarios.

Variable costs for the treatment plant and water well systems include energy cost, chemical cost and operation cost. These costs change as monthly water demands vary and as relative demands placed on surface water and well water supplies vary.

The deliverable cost of water for the conjunctive use of Lake Bosque water and groundwater is the combined cost to the participants to develop the Lake Bosque Project by BRA, capital cost of the treatment and transmission system and the variable costs of operating and maintaining the system and existing water wells.

The deliverable cost of water can be established by two general methods.

(1) Proportionate cost

(2) Uniform cost

Under a proportionate cost scenario, each participant pays for the portion of the system required to serve its demands. The system cost for this scenario were presented in the previous section (Section VI).

Under a uniform cost scenario each participant has the same deliverable water cost. In the interest of a regional water supply system, this may make the cost of such a system feasible to a greater number of participants.

Proportionate Cost

A summary of estimated proportionate deliverable water cost is shown in Table VII-1

TABLE VII-1

PROPORTIONATE DELIVERABLE WATER COST
ORIGINAL CONTRACT
$/1000 GALLONS

PARTICIPANT	ALT. NO. 1		ALT. NO. 2		ALT. NO. 3		ALT. NO. 4	
	YEAR 2000	YEAR 2020	YEAR 2000	YEAR 2020	YEAR 2000	YEAR 2020	YEAR 2000	YEAR 2020
Clifton	3.82	3.05	2.79	2.22	4.04	3.23	3.41	2.72
Meridian	5.45	4.36	2.63	2.12	5.59	4.47	3.17	2.55
Valley Mills	-	-	3.53	3.14	-	-	-	-
Iredell	-	-	4.68	3.67	-	-	-	-
Walnut Springs	-	-	3.54	2.81	-	-	4.11	3.26
Morgan	-	-	3.55	2.62	-	-	-	-
Cranfills Gap	-	-	6.91	5.22	-	-	7.48	5.64
Childress Creek WSC	-	-	3.13	2.53	-	-	4.00	3.23
Mustang WSC	-	-	3.51	2.55	-	-	-	-

As can be seen from this table this method of cost determination results in a wide range of deliverable water cost for potential participants. Complete annual costs for the years 2000 and 2020 are shown in Appendix C and D, respectively.

Uniform Cost

A uniform cost method of determining deliverable cost of water assumes all participants pay an equal part of the total system cost. A summary of estimated uniform deliverable water cost is shown in Table VII-2.

TABLE VII-2

UNIFORM DELIVERABLE WATER COST
ORIGINAL CONTRACT
$/1000 GALLONS

ALT. NO.	TOTAL COST	TOTAL DEMAND (MG)	$/1000 GAL.	TOTAL COST	TOTAL DEMAND (MG)	$/1000 GAL.
1	$1,583,692	372.37	$4.25	$1,600,450	470.93	$3.40
2	2,172,834	679.00	3.20	2,193,416	854.25	2.57
3	1,657,223	372.37	4.45	1,673,883	470.93	3.55
4	1,924,568	522.04	3.69	1,944,496	660.76	2.94

B. Recommended Alternative

The results of this study will serve as a basis for each entity in Bosque County to evaluate the feasibility of utilizing Lake Bosque water. Once this is done, the participants desiring to commit the funds to be a part of such a regional water supply entity can be identified. Through correspondence to date several potential participants (Childress Creek WSC and Walnut Springs) have expressed a desire to utilize Lake Bosque water.

For purposes of this study, alternative No. 4 is recommended for a detailed study and potential implementation. This water supply system alternative considers supplying Lake Bosque water for the conjunctive use with existing wells to those entities that are projected to need additional water supplies by the year 2020. Those entities include Clifton, Meridian, Walnut Springs, Cranfills Gap, and Childress Creek Water Supply Corporation.

In the analysis of the various alternatives, the system components and their cost to supplement groundwater supplies with surface water to each major public water supply system in the planning area were evaluated. Therefore, each potential participant will have an estimate of the system requirements and cost if they elect to pursue utilization of Lake Bosque water. A hydraulic profile for the recommended system through Meridian and Clifton is shown on Figure VII-1.

C. Savings Reflecting Implementation of Conservation Practices

The implementation of conservation practices recommended by the Brazos River Authority and Texas Water Development Board for Bosque County will have a significant impact in reducing future water demands, as shown in Section II of this report.

This will maximize the use of this limited natural resource and help insure the availability of desirable water supplies in the future. The implementation of these practices will also result in lower water bills for consumers. The potential annual water bill savings per connection for the recommended alternative by the year 2020 is shown in Table VII-3.

TABLE VII-3

ANNUAL WATER COST SAVINGS WITH CONSERVATION PRACTICES

PARTICIPANT	$/1000 GAL.	WITHOUT CONSERVATION GAL/CAP-DAY	WITHOUT CONSERVATION ANNUAL COST*	WITH CONSERVATION GAL/CAP-DAY	WITH CONSERVATION ANNUAL COST	ANNUAL SAVINGS PER CONNECTION
Clifton	2.72	198	$452	168	$384	$68
Meridian	2.55	164	$351	139	$297	$54
Walnut Springs	3.26	139	$380	118	$322	$58
Cranfills Gap	5.64	139	$658	118	$559	$99
Childress Creek WSC	3.23	139	$377	118	$320	$57

* Assuming 2.3 persons per connection.

These cost savings are based on the deliverable cost of water. Cost savings based on actual future water rates established by each participant may be greater.

D. Option and Current Use Water

In January, 1989, the Brazos River Authority presented a proposed contract revision to the City of Clifton and the City of Meridian which would substantially reduce the annual cost of the Bosque County participant's share of the Lake Bosque Project. This proposal was accepted by resolution in March, 1989.

The revised contract consists of operating Lake Bosque as a part of the Brazos River Authority's basin-wide system of water supply reservoirs. This provides for all new water supply customers to share the costs for exiting and future water supplies.

Under the original Current Use contract, the entire Bosque County participant's share of water is charged at a single rate of $85 per acre-foot. The present contract establishes two rates:

1. Current Use Water $85 per acre-foot ($95,291 per mgd)
2. Option Water $10 per acre-foot ($11,210 per mgd)

Under the present contract, the City of Clifton and the City of Meridian would pay the Current Use Water Rate for projected water needs through the year 2026 and the Option Water Rate on the balance of their total water rights.

A summary of these two contracts is shown below.

TABLE VII-4

OPTION AND CURRENT USE WATER COST
B.R.A. CONTRACT

	Original Contract	Present Contract
Clifton		
Contract Amount (mgd)	1.74	1.74
Current Use Water (mgd)	1.74	1.04
Option Water (mgd)	0.00	0.70
Estimated Annual Payment	$544,920.00	$106,950.00
Meridian		
Contract Amount (mgd)	1.23	1.23
Current Use Water (mgd)	1.23	0.37
Option Water (mgd)	0.00	0.86
Estimated Annual Payment	$384,660.00	$44,900.00

As can be seen, the revised contract greatly reduces Clifton and Meridian's annual Lake Bosque water debt payment. However, this contract is based solely on the projected year 2026 demands for Clifton and Meridian of 1.41 mgd. It has been shown in this study that several other entities in Bosque County will need additional water supplies by the year 2020.

In order to maximize the beneficial use of Lake Bosque to entire County, it is recommended that the Bosque County participants increase their current use water rights based on the total needs of interested participants through the year 2020.

A change to the present BRA contract reflecting the recommended alternative (Alternative No. 4) is shown in the table below.

TABLE VII-5

OPTION AND CURRENT USE WATER COST
RECOMMENDED REGIONAL ALTERNATIVE

PARTICIPANT	CONTRACT AMOUNT	CURRENT USE WATER (MGD)	OPTION WATER (MGD)
Clifton	1.74	1.04	.56
Meridian	1.23	0.37	.20
Walnut Springs	-	0.14	.08
Cranfills Gap	-	0.08	.04
Childress Creek WSC		0.30	.16
	2.97	1.93	1.04

The estimated annual water debt service to each participant for such a revised contract is shown in Table VII-6.

TABLE VII-6

ANNUAL WATER DEBT COST
RECOMMENDED REGIONAL ALTERNATIVE

PARTICIPANT	ORIGINAL AGREEMENT	OPTION/CURRENT USE CONTRACT
Clifton	$446,196	$105,380
Meridian	316,056	37,500
Walnut Springs	46,476	14,238
Cranfills Gap	27,888	8,072
Childress Creek WSC	92,952	30,380
	$929,568	$195,570

As can be seen, such a revised contract with the Brazos River Authority offers a substantial reduction in annual water cost. Incorporating these revised water debt cost results in considerably lower delivered water cost.

The revised deliverable water cost can be determined by substituting the lower water debt cost in the tables in Appendix C and D for alternative No. 4. The resulting deliverable water cost are shown in Table VII-7.

TABLE VII-7

DELIVERABLE WATER COST/1000 GAL.
RECOMMENDED REGIONAL ALTERNATIVE

PARTICIPANT	ORIGINAL AGREEMENT		OPTION/CURRENT USE CONTRACT	
	Year 2000	Year 2020	Year 2000	Year 2020
Clifton	$ 3.41	2.72	$ 2.00	$ 1.61
Meridian	3.17	2.55	1.78	1.44
Walnut Springs	4.11	3.26	2.67	2.13
Cranfills Gap	7.48	5.64	6.25	4.50
Childress Creek WSC	4.00	3.23	2.33	$ 2.10

E. Water Rates

One task of this study is to assist the Cities of Clifton and Meridian in determining possible water rates to allow implementation of the recommended alternative.

The present water rates for the Cities of Clifton and Meridian are shown in Table VII-8.

TABLE VII-8
PRESENT WATER RATES

	Base Cost (up to 3,000 gal)	Cost per 1,000 gallons		
		3,0000 - 10,000 gal.	10,000 - 20,000 gal.	Over 20,000 gal.
Clifton				
Residential	$15.00	$1.75	$2.00	$2.00
Commercial	$17.50	$1.75	$2.00	$2.00
Meridian				
Residential	$11.50	$1.55	$2.25	$2.75
Commercial	$11.50	$1.55	$2.25	$2.75

A detailed water rates analysis is beyond the scope of this study. However, the basic water rate required to cover the deliverable cost of water can be established. One possible water rate structure based on the recommended BRA contract revision and proportionate deliverable water cost is shown in Table VII-9.

TABLE VII-9

POSSIBLE FUTURE WATER RATES
RECOMMENDED B.R.A. CONTRACT AMENDMENT
YEAR 2000

	Base Cost (up to 3,000 gal)	Cost per 1,000 gallons: 3,0000 - 10,000 gal.	10,000 - 20,000 gal.	Over 20,000 gal.
Clifton				
Residential	20.00	2.00	2.25	2.50
Commercial	20.00	2.00	2.25	2.50
Meridian				
Residential	20.00	2.00	2.25	2.50
Commercial	20.00	2.00	2.25	2.50

These rates are based solely on paying for the costs presented for implementation of the recommended alternative. They do not include retiring any previously acquired debt for existing water systems nor do they include costs for system replacement or repairs. A more detailed rate study is recommended prior to setting final future water rates.

F. Implementation Schedule

The recommended water supply system components to deliver Lake Bosque water are all required when Lake Bosque becomes operational. The anticipated completion of the Lake Bosque Project in late 1992 as presented in a 1988 BRA report. However, recent delays in the permit approval by the Texas Water Commission will extend the project completion. The acquisition of necessary land is also a major milestone that must be achieved before construction of the project can begin.

In the analysis of various water supply system alternatives, it is assumed that surface water utilization will begin in the year 2000. However, for implementation scheduling purposes it is assumed that Lake Bosque will become operational by 1996. This will allow initial implementation of the recommended water supply system in the event the lake project proceeds forward without further delays.

Assuming the participation of those entities identified as needing additional water supplies by the year 2020 all water supply system components for the recommended alternative (alternative No. 4) are required initially. It is recommended that the water treatment plant be constructed with an initial design capacity of 2.0 mgd.

Other considerations with regard to BRA include:

1. Based upon its recent activities elsewhere in the basin, BRA would not use it's bond capability to obtain funds for implementation of the Bosque County system. Funding would be developed from abilities of the system users to sell bonds or obtain grants from other agencies.

2. BRA might not enter into management/operation contract with Bosque County unless it fully owned the facilities which it managed.

3. While regional in character, a question remains whether BRA can truly present itself impartially to Bosque County and still serve downstream high water usage interests which are located within the Brazos River basin.

City or Coalition of Cities

City operation of a county-wide water system within Bosque County is not considered a viable option for a variety of reasons. These reasons include:

1. A city would not have jurisdictional or taxation powers beyond its city limit boundary. This would be a serious short-coming in dealing with water users located elsewhere within the county.

2. Management of a county wide water system may prove to place an unfair burden on the "operating city" particularly in light of operating revenues, manpower requirements, and debt retirement.

3. Operation of a water system by a city or coalition could polarize various factions within the County and limit overall effectiveness in mangement.

4. Acquisition of funds through revenue bonds or tax bonds by a city located in Bosque County may prove to be difficult when considering the capital required to implement and manage a county water system.

Bosque County

Operation and management of a regional water system by Bosque County would remove some barriers faced by a city operated and managed system. As an example, the county does have power of taxation over the entire county. A possible problem could arise if those cities which are not totally within the county choose to participate. The most notable city which is not totally contained in the county is Valley Mills.

Other items to be considered regarding County management include:

1. Counties are typically not equipped to manage water systems. Legally there is less precedent for a county system. Structurally they typically do not maintain experienced staff to operate water supply systems.

2. Funding by county bond sales may prove to be difficult to obtain.

It is more feasible to install the anticipated year 2020 design capacity initially than to phase construction of the facility over the study period. This is also the case for the raw water pipeline, transmission pipeline and booster pump stations. A schedule for the implementation of the recommended water supply system is shown on Table VII-11.

G. Management and Operation Alternatives

General

There are several different management systems currently in use today which operate and manage water utility systems. The following paragraphs list and discuss various management systems and provide general information which pertain to specific management methods. It is important to note that the most desirable management system is the operational method which can cross geographical and political boundaries and provide a fair and unbiased operation. Specific needs within a regional area will often dictate the more favorable management system to be utilized.

Management Agencies

Various agencies which might be considered for management and operation of a water supply system in Bosque County include:

A. Brazos River Authority;
B. A City or Coalition of Cities;
C. Bosque County;
D. Private Water Company;
E. Non-Profit Water Supply Corporation, and;
F. Non-Profit Water Supply District.

Brazos River Authority

The Brazos River Authority (BRA) has expressed an interest in managing and operating a future regional water system for Bosque County. This agency has a history of successfully operating wastewater treatment plants throughout the Brazos River Basin. In recent years BRA has entered operation and management of potable water plants or systems. BRA could offer many advantages as possible manager/operator of the Bosque County regional system. These advantages include:

1. An organization with strong management skills and a proven track record with similar systems.

2. The ability to provide a "turn-key service" for a yearly fixed fee. The fee is normally based on a percentage of both debt service and operation and maintenance costs.

3. BRA, by its organizational nature, appears as a "regional entity" and possible could function somewhat independently and avoid the pitfalls of local politics within Bosque County.

Other considerations with regard to BRA include:

1. Based upon its recent activities elsewhere in the basin, BRA would not use it's bond capability to obtain funds for implementation of the Bosque County system. Funding would be developed from abilities of the system users to sell bonds or obtain grants from other agencies.

2. BRA might not enter into management/operation contract with Bosque County unless it fully owned the facilities which it managed.

3. While regional in character, a question remains whether BRA can truly present itself impartially to Bosque County and still serve downstream high water usage interests which are located within the Brazos River basin.

City or Coalition of Cities

City operation of a county-wide water system within Bosque County is not considered a viable option for a variety of reasons. These reasons include:

1. A city would not have jurisdictional or taxation powers beyond its city limit boundary. This would be a serious short-coming in dealing with water users located elsewhere within the county.

2. Management of a county wide water system may prove to place an unfair burden on the "operating city" particularly in light of operating revenues, manpower requirements, and debt retirement.

3. Operation of a water system by a city or coalition could polarize various factions within the County and limit overall effectiveness in mangement.

4. Acquisition of funds through revenue bonds or tax bonds by a city located in Bosque County may prove to be difficult when considering the capital required to implement and manage a county water system.

Bosque County

Operation and management of a regional water system by Bosque County would remove some barriers faced by a city operated and managed system. As an example, the county does have power of taxation over the entire county. A possible problem could arise if those cities which are not totally within the county choose to participate. The most notable city which is not totally contained in the county is Valley Mills.

Other items to be considered regarding County management include:

1. Counties are typically not equipped to manage water systems. Legally there is less precedent for a county system. Structurally they typically do not maintain experienced staff to operate water supply systems.

2. Funding by county bond sales may prove to be difficult to obtain.

3. A county operated water system may find it difficult to operate impartially due to the presence of strong commissioners who are in charge of precincts located within the county.

Private Water Company

A private water company is not considered a viable management system for Bosque County. All private water companies are carefully monitored by the Texas Water Commission. Water rates are regulated and as such profitability is severely limited. Because of rate regulation, funding by sale of revenue bonds is nearly impossible. Additionally, private companies have no taxing power which closes another funding avenue.

Non-Profit Water Supply Corporation or Water Supply District

A non-profit water supply corporation or water supply district have many similar capabilities. Both organizations may be created by special legislation which will allow special concerns to be addressed. Special concerns might include number and location of the members who comprise the board, noting strengths of the various members of the board or member cities, and other concerns.

Each of these organizations provide a "third party" which may be necessary to resolve geographical or perceived special considerations. There are some major differences between a water supply district and a water supply corporation. These differences include:

1. A water supply district may:

   a. Sell revenue bonds;
   b. apply an "ad volorum" tax for revenue production;
   c. utilize certain portions of public right-of-way for locating transmission lines and;
   d. may cross county or other political boundaries where necessary.

2. A water supply corporation typically:

   a. Cannot tax to raise funds for operation and debt retirement;
   b. due to limited bond sale capability it may receive special consideration by the state when applying for funding for project costs;
   c. may have difficulty in extending its powers beyond county boundaries and;
   d. may not have the same powers as a special district when attempting to acquire right-of-way for transmission lines and other related facilities.

Recommendation

It is recommended that a non-profit water supply corporation or non-profit water supply district be considered as the method for management and operation of the Bosque County Regional Water Supply System. This management system will:

1. Retain control and ownership of the water system by the citizens of Bosque County;

2. provide an "unbiased" third party who can resolve special considerations involving geographic or other differences which might arise within Bosque County;

3. due to its ability to incorporate "special" requirements, as part of its creation, can meet a variety of special requirements which are peculiar to Bosque County, and;

4. offers a variety of methods for developing funds for construction, maintenance and operation of the system.

H. Utilization Plan

The operation of the Lake Bosque water supply system will consist of a combined utilization of surface water and well. It is desirable to operate the system such that it maximize the use of both Lake Bosque water and groundwater while at the same time is the most cost effective.

The costs of producing both surface water and well water were presented in estimating the deliverable cost of water. These costs reflect using surface water to meet average daily demands and well water to supplement during periods of increased demands. Basing the water supply system infrastructure on this operation scenario maximizes the beneficial use of Lake Bosque for the entire county. Utilization of surface water at a significantly higher rate would not provide sufficient firm lake yield to meet future demands of all potential participants in the County.

Conversely, the estimated energy and chemical costs to treat and distribute surface water totals approximately $.13/1000 gallons compared to $.25/1000 gallons for well water. Therefore, it is economically more desirable to base load system demands with surface water.

It is recommended that Bosque County participants use surface water to meet average daily demands and use ground water to meet periods of increased demands. Existing and planned storage facilities can also be used to increase the utilization of surface water to meet demands.

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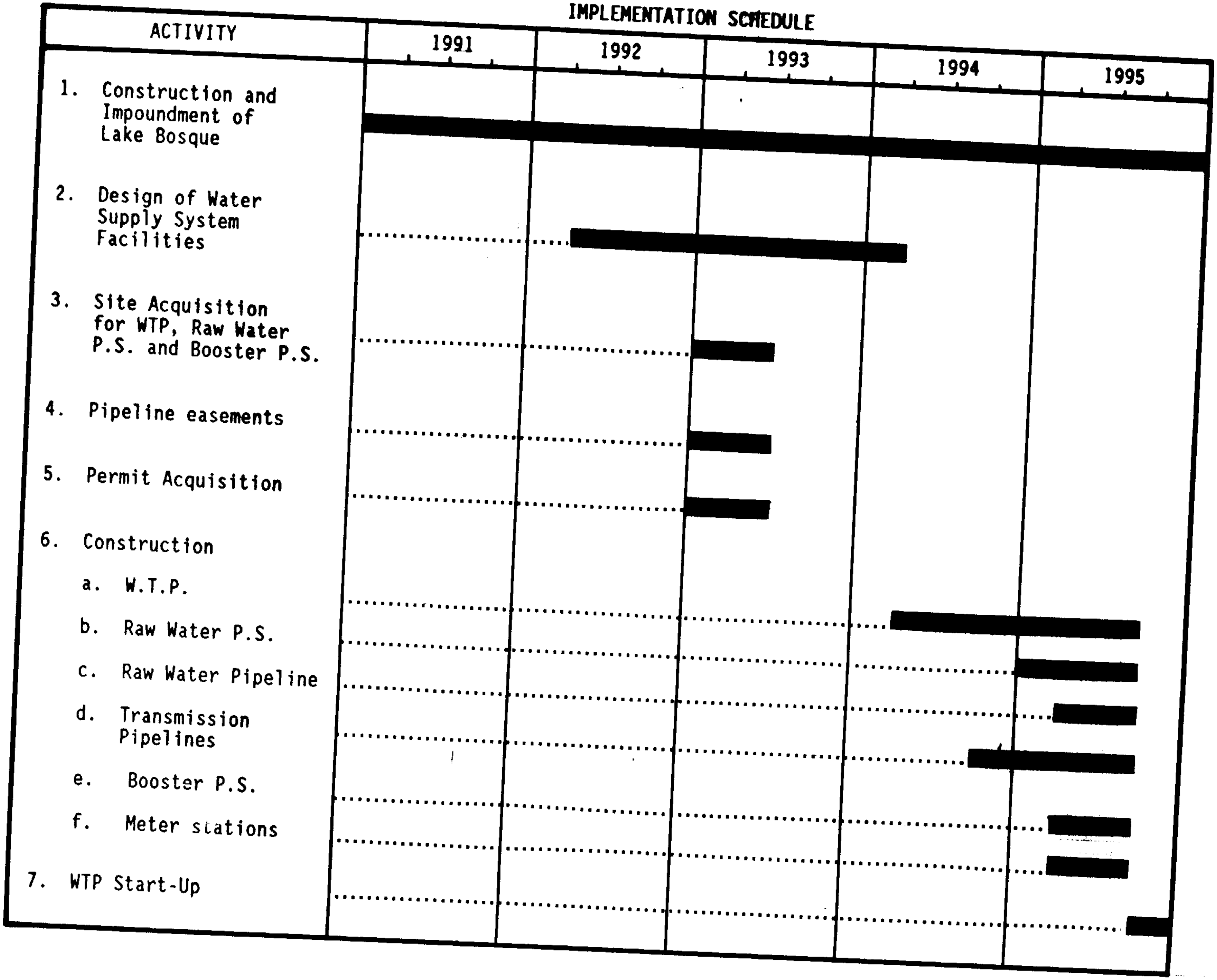
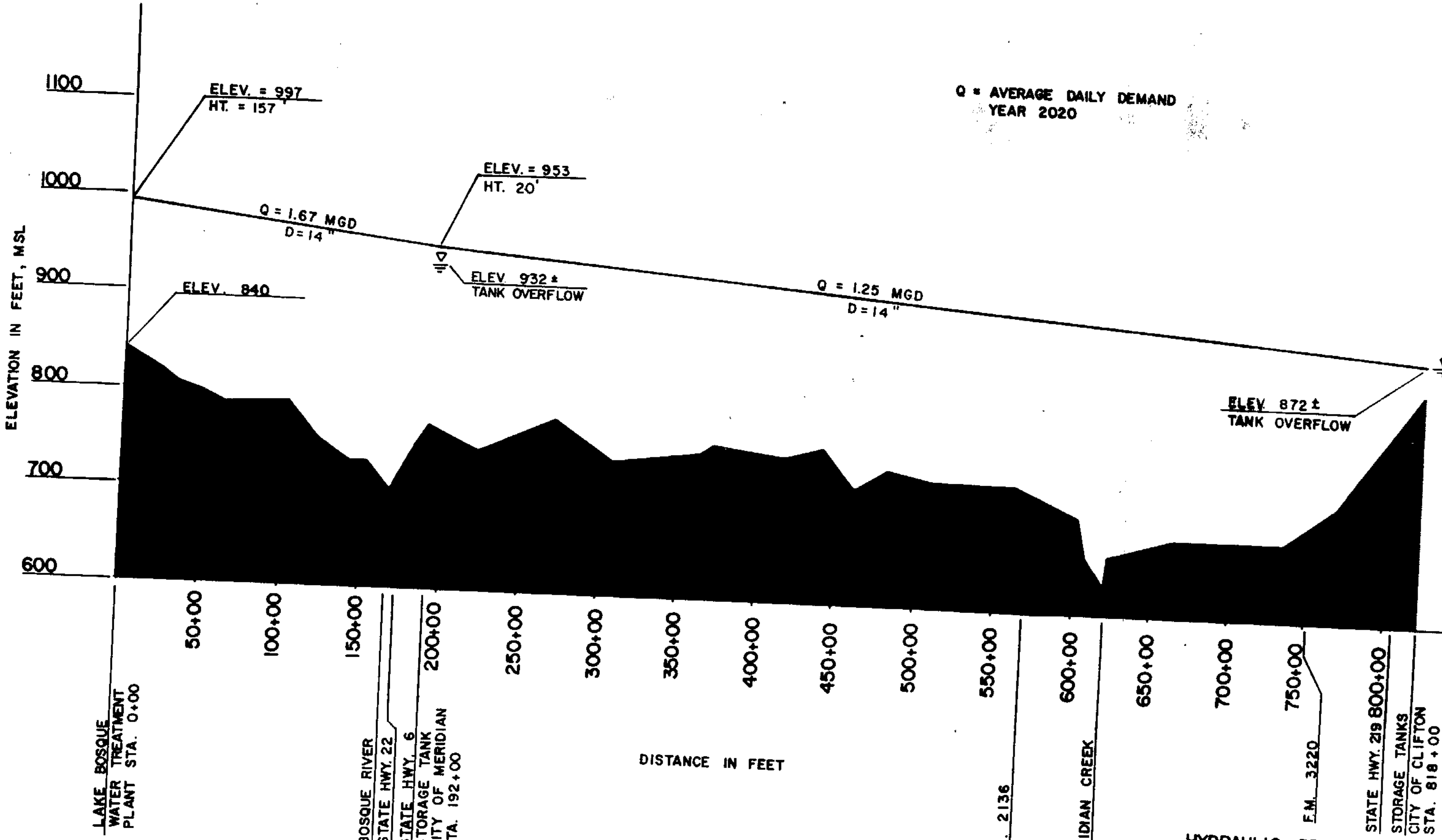
TABLE VII-10

IMPLEMENTATION SCHEDULE





DANNENBAUM ENGINEERING CORPORATION

HYDRAULIC PROFILE
SUPPLY SYSTEM ALTERNATIVE 4

FIGURE VII-1

Section VIII
Financing Alternatives

SECTION VIII

FUNDING METHODS

General

There are several potential funding alternatives which may be available for use in obtaining construction and implementation funds for a region water system in Bosque County. This section presents some of the more common methods that may be utilized.

Historically civil projects have been funded by the sale of various types of bonds by the managing entity or grants issued by a governmental agency. Typically even the grants are a form of bond sale in which the bonding agency agrees to purchase all bonds required to finance the project.

A. Types of Bonds

Bonds can be broadly defined as revenue bonds or tax bonds. As the names suggest each type of bond derives from revenues (water sales) or from a tax base (ad valorem tax).

Revenue bonds may be issued by a managing entity such as a city, a water supply corporation or water supply district.

Tax bonds (general obligation bonds) typically are issued by a water supply district.

Combination bonds are a form of bonds which combine revenue bonds with general obligation bonds. This particular method provides a tax base which produces sufficient revenue to implement and start-up a water system. When revenue is developed by operating the system, the tax bonds are retired.

B. Grants and Loans

There are a number of governmental grant programs currently available for funding water system infrastructure projects. Two programs which may be applicable to Bosque include grants from the Farmers Home Administration, and the Water Development Board.

The Farmers Home Administration Program (FHA) operates a funding program for construction of rural water supply corporations.

The Water Development Board offers a program for providing funds for construction of water supply systems. The state typically will sell general obligation bonds to raise the funds necessary to purchase bonds which may be issued by cities or water supply districts.

The State also offers a "hardship" program through its Water Development Supply Program. Typically a regional system may not be required to satisfy the hardship clause of this particular program. Loans issued through this program are intended to ensure that the State is the only lender willing to participate in the project and all other funding alternatives have been exhausted.

Feasibility of Selling Revenue Bonds by City

Revenue bonds typically financed by proceeds resulting from the sale of a product, i.e. treated water. They are more favorably received when issued by an existing entity either a city or non-profit water supply district. To gain the most favorable interest and other considerations relating to bond sales, the entity should be able to show a "track record" or other evidence of sound management along with a high prospect of meeting the anticipated repayment schedule.

The ability to sell revenue bonds is also governed by the credit rating of the issuing entity, the economic climate at the time and the general location of the facilities to be constructed.

Due to the magnitude of estimated cost for construction of potential alternatives (from 4 million to 10 million dollars), there may be a question as to the ability of either Clifton or Meridian or a combination of both cities to successfully sell revenue bonds. Also, other important projects may be jeopardized by the sale of large amounts of revenue bonds. These projects might include street improvements and wastewater infrastructure improvements.

The final decision as to whether a city or group of cities should sell revenue bonds for funding a regional water system should be made after:

1. a specific plan has been selected for implementation in order to establish an estimated construction cost;

2. an in depth economic analysis of the bond market at a time when funds are required;

3. an analysis of current indebtedness of the operating entity, and;

4. a rate structure has been developed which will develop a cash flow dedicated to meeting operation, maintenance and debt retirement.

kn:03414JL

SUMMARY OF
CAPITAL COST

Alternative No.	Raw Water Supply $ 1,000's	Water Treatment Plant $ 1,000's	Transmission Lines $ 1,000's	Total $ 1,000's
1	426	2,160	1,989	4,575
2	516	3,540	6,385	10,441
3	510	2,160	2,733	5,403
4	468	2,940	4,653	8,061

kn:03361

Appendix A

ALTERNATIVE NO. 1
RAW WATER SUPPLY SYSTEM COST ESTIMATES

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1. Raw water pump station (1.5 mgd)	1	LS	$250,000.00	$ 250,000.00
2. 14" D.I.P.	5000	LF	21.00	105,000.00
			Sub-Total	$ 355,000.00
			Engineering & Contigency (20%)	70,000.00
			ALTERNATIVE NO. 1 TOTAL	$ 426,000.00

ALTERNATIVE NO. 2
RAW WATER SUPPLY SYSTEM COST ESTIMATES

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1. Raw water pump station (2.5 mgd)	1	LS	325,000.00	$ 325,000.00
2. 14" D.I.P.	5000	LF	21.00	105,000.00
			Sub-Total	$ 430,000.00
			Engineering & Contigency (20%)	86,000.00
			ALTERNATIVE NO. 2. TOTAL	$ 516,000.00

ALTERNATIVE NO. 3
RAW WATER SUPPLY SYSTEM COST ESTIMATE

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1. Raw water pump station (1.5 mgd)	1	LS	250,000.00	$ 250,000.00
2. 18" D.I.P.	5000	LF	35.00	175,000.00
			Sub-Total	$ 425,000.00
	Engineering & Contigency (20%)			85,000.00
	ALTERNATIVE NO. 3 TOTAL			$ 510,000.00

ALTERNATIVE NO. 4
RAW WATER SUPPLY SYSTEM COST ESTIMATE

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1. Raw water pump station (2.0 mgd)	1	LS	285,000.00	$ 285,000.00
2. 14" D.I.P.	5000	LF	21.00	105,000.00
			Sub-Total	$ 390,000.00
	Engineering & Contigency (20%)			78,000.00
	ALTERNATIVE NO. 4 TOTAL			$ 468,000.00

ALTERNATIVE NO. 1
WATER TREATMENT PLANT COST ESTIMATE

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1. Water treatment facilities (1.5 mgd)	1	LS	1,250,000	$1,250,000.00
2. High service pump station	1	LS	250,000	250,000.00
3. Storage reservoir (1.5 million gallons)	1	EA	300,000	300,000.00
			Sub-Total	$1,800,000.00
	Engineering & Contigency (20%)			360,000.00
	ALTERNATIVE NO. 1 TOTAL			$2,160,000.00

ALTERNATIVE NO. 2
WATER TREATMENT PLANT COST ESTIMATE

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1. Water treatment facilities (2.5 mgd)	1	LS	2,100,000	$2,1000,000.00
2. High service pump station	1	LS	350,000	350,000.00
3. Storage reservoir (2.5 million gallons)	1	EA	500,000	500,000.00
			Sub-Total	$2,950,000.00
	Engineering & Contigency (20%)			590,000.00
	ALTERNATIVE NO. 2 TOTAL			$3,540,000.00

ALTERNATIVE NO. 3
WATER TREATMENT PLANT COST ESTIMATE

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1. Water treatment facilities (1.5 mgd)	1	LS	1,250,000	$1,250,000.00
2. High service pump station	1	LS	250,000	250,000.00
3. Storage reservoir (1.5 million gallons)	1	EA	300,000	30,000.00
			Sub-Total	$1,800,000.00
	Engineering & Contigency (20%)			360,000.00
	ALTERNATIVE NO. 3 TOTAL			$2,160,000.00

ALTERNATIVE NO. 4
WATER TREATMENT PLANT COST ESTIMATE

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1. Water treatment facilities (2.0 mgd)	1	LS	1,750,000	$1,750,000.00
2. High service pump station	1	LS	300,000	300,000.00
3. Storage reservoir (2.0 mgd)	1	EA	400,000	400,000.00
			Sub-Total	$2,450,000.00
	Engineering & Contigency (20%)			490,000.00
	ALTERNATIVE NO. 4 TOTAL			$2,940,000.00

Appendix B

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 1
TRANSMISSION SYSTEM COST ESTIMATE

DESCRIPTION	UNIT	APPROXIMATE QUANTITY	UNIT PRICE	TOTAL AMOUNT
LINE A				
12" P.V.C.	LF	21,500	$16.00	$344,000.00
VALVES	LS	1	$27,500.00	$27,500.00
20" BORE AND ENCASE	LF	180	$210.00	$37,800.00
SUB - TOTAL LINE A				$409,300.00
			ENGINEERING & CONTINGENCY (20%)	$81,860.00
			TOTAL LINE A	$491,160.00
LINE A-1				
6" P.V.C.	LF	5,200	$10.00	$52,000.00
12" BORE AND ENCASE	LF	300	$120.00	$36,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE A-1				$108,000.00
			ENGINEERING & CONTINGENCY (20%)	$21,600.00
			TOTAL LINE A-1	$129,600.00
LINE A-2				
6" P.V.C.	LF	2,600	$10.00	$26,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE A-2				$46,000.00
			ENGINEERING & CONTINGENCY (20%)	$9,200.00
			TOTAL LINE A-2	$55,200.00
LINE B				
12" P.V.C.	LF	62,600	$16.00	$1,001,600.00

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 1
TRANSMISSION SYSTEM COST ESTIMATE

DESCRIPTION	UNIT	APPROXIMATE QUANTITY	UNIT PRICE	TOTAL AMOUNT
VALVES	LS	1	$47,500.00	$47,500.00
20" BORE AND ENCASE	LF	120	$210.00	$25,200.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE B				$1,094,300.00
			ENGINEERING & CONTINGENCY (20%)	$218,860.00
			TOTAL LINE B	$1,313,160.00
			ALTERNATIVE NO. 1 TOTAL	$1,989,120.00

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2
TRANSMISSION SYSTEM COST ESTIMATE

DESCRIPTION	UNIT	APPROXIMATE QUANTITY	UNIT PRICE	TOTAL AMOUNT
LINE A				
14" D.I.P.	LF	21,500	$21.00	$451,500.00
VALVES	LS	1	$27,500.00	$27,500.00
24" BORE AND ENCASE	LF	180	$240.00	$43,200.00
SUB - TOTAL LINE A				$522,200.00
			ENGINEERING & CONTINGENCY (20%)	$104,440.00
			TOTAL LINE A	$626,640.00
LINE A-1				
6" P.V.C.	LF	5,200	$10.00	$52,000.00
12" BORE AND ENCASE	LF	300	$120.00	$36,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE A-1				$108,000.00
			ENGINEERING & CONTINGENCY (20%)	$21,600.00
			TOTAL LINE A-1	$129,600.00
LINE A-2				
6" P.V.C.	LF	2,600	$10.00	$26,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE A-2				$46,000.00
			ENGINEERING & CONTINGENCY (20%)	$9,200.00
			TOTAL LINE A-2	$55,200.00

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2
TRANSMISSION SYSTEM COST ESTIMATE

DESCRIPTION	UNIT	APPROXIMATE QUANTITY	UNIT PRICE	TOTAL AMOUNT
LINE B				
14" P.V.C.	LF	62,600	$21.00	$1,314,600.00
VALVES	LS	1	$47,500.00	$47,500.00
24" BORE AND ENCASE	LF	120	$240.00	$28,800.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE B				$1,410,900.00
			ENGINEERING & CONTINGENCY (20%)	$282,180.00
			TOTAL LINE B	$1,693,080.00
LINE C				
8" P.V.C.	LF	14,800	$12.00	$177,600.00
VALVES	LS	1	$15,000.00	$15,000.00
12" BORE AND ENCASE	LF	600	$120.00	$72,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
BOOSTER PUMP STATION (.56 M.G.D.)	LS	1	$125,000.00	$125,000.00
SUB - TOTAL LINE C				$409,600.00
			ENGINEERING & CONTINGENCY (20%)	$81,920.00
			TOTAL LINE C	$491,520.00
LINE D				
6" P.V.C.	LF	39,000	$10.00	$390,000.00
VALVES	LS	1	$35,000.00	$35,000.00
SUB - TOTAL LINE D				$425,000.00
			ENGINEERING & CONTINGENCY (20%)	$85,000.00
			TOTAL LINE D	$510,000.00

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2
TRANSMISSION SYSTEM COST ESTIMATE

DESCRIPTION	UNIT	APPROXIMATE QUANTITY	UNIT PRICE	TOTAL AMOUNT
LINE E				
4" P.V.C.	LF	60,700	$7.00	$424,900.00
VALVES	LS	1	$55,000.00	$55,000.00
10" BORE AND ENCASE	LF	420	$100.00	$42,000.00
SUB - TOTAL LINE E				$521,900.00
			ENGINEERING & CONTINGENCY (20%)	$104,380.00
			TOTAL LINE E	$626,280.00
LINE F				
4" P.V.C.	LF	33,500	$7.00	$234,500.00
VALVES	LS	1	$30,000.00	$30,000.00
10" BORE AND ENCASE	LF	300	$100.00	$30,000.00
SUB - TOTAL LINE F				$294,500.00
			ENGINEERING & CONTINGENCY (20%)	$58,900.00
			TOTAL LINE F	$353,400.00
LINE G				
6" P.V.C.	LF	72,400	$10.00	$724,000.00
VALVES	LS	1	$65,000.00	$65,000.00
10" BORE AND ENCASE	LF	180	$100.00	$18,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
BOOSTER PUMP STATION (.15 M.G.D.)	LS	1	$60,000.00	$60,000.00
SUB - TOTAL LINE G				$887,000.00
			ENGINEERING & CONTINGENCY (20%)	$177,400.00
			TOTAL LINE G	$1,064,400.00

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2
TRANSMISSION SYSTEM COST ESTIMATE

DESCRIPTION	UNIT	APPROXIMATE QUANTITY	UNIT PRICE	TOTAL AMOUNT
LINE H				
4" P.V.C.	LF	6,200	$7.00	$43,400.00
VALVES	LS	1	$5,000.00	$5,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE H				$68,400.00
			ENGINEERING & CONTINGENCY (20%)	$13,680.00
			TOTAL LINE H	$82,080.00
LINE I				
4" P.V.C.	LF	9,500	$7.00	$66,500.00
VALVES	LS	1	$10,000.00	$10,000.00
10" BORE AND ENCASE	LF	200	$100.00	$20,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE I				$116,500.00
			ENGINEERING & CONTINGENCY (20%)	$23,300.00
			TOTAL LINE I	$139,800.00
LINE J				
6" P.V.C.	LF	49,600	$10.00	$496,000.00
VALVES	LS	1	$15,000.00	$15,000.00
SUB - TOTAL LINE J				$511,000.00
			ENGINEERING & CONTINGENCY (20%)	$102,200.00
			TOTAL LINE J	$613,200.00

ALTERNATIVE NO. 4 TOTAL $6,385,200.00

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 3
TRANSMISSION SYSTEM COST ESTIMATE

DESCRIPTION	UNIT	APPROXIMATE QUANTITY	UNIT PRICE	TOTAL AMOUNT
LINE A				
16" D.I.P.	LF	21,500	$28.00	$602,000.00
VALVES	LS	1	$27,500.00	$27,500.00
24" BORE AND ENCASE	LF	180	$240.00	$43,200.00
SUB - TOTAL LINE A				$672,700.00
			ENGINEERING & CONTINGENCY (20%)	$134,540.00
			TOTAL LINE A	$807,240.00
LINE A-1				
10" P.V.C.	LF	5,200	$14.00	$72,800.00
18" BORE AND ENCASE	LF	300	$160.00	$48,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE A-1				$140,800.00
			ENGINEERING & CONTINGENCY (20%)	$28,160.00
			TOTAL LINE A-1	$168,960.00
LINE A-2				
10" P.V.C.	LF	2,600	$14.00	$36,400.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE A-2				$56,400.00
			ENGINEERING & CONTINGENCY (20%)	$11,280.00
			TOTAL LINE A-2	$67,680.00

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 3
TRANSMISSION SYSTEM COST ESTIMATE

DESCRIPTION	UNIT	APPROXIMATE QUANTITY	UNIT PRICE	TOTAL AMOUNT
LINE B				
14" D.I.P.	LF	62,600	$21.00	$1,314,600.00
VALVES	LS	1	$47,500.00	$47,500.00
20" BORE AND ENCASE	LF	120	$210.00	$25,200.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE B				$1,407,300.00
			ENGINEERING & CONTINGENCY (20%)	$281,460.00
			TOTAL LINE B	$1,688,760.00
			ALTERNATIVE NO.3 TOTAL	$2,732,640.00

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 4
TRANSMISSION SYSTEM COST ESTIMATE

DESCRIPTION	UNIT	APPROXIMATE QUANTITY	UNIT PRICE	TOTAL AMOUNT
LINE A				
14" D.I.P.	LF	21,500	$21.00	$451,500.00
VALVES	LS	1	$27,500.00	$27,500.00
24" BORE AND ENCASE	LF	180	$240.00	$43,200.00
SUB - TOTAL LINE A				$522,200.00
			ENGINEERING & CONTINGENCY (20%)	$104,440.00
			TOTAL LINE A	$626,640.00
LINE A-1				
6" P.V.C.	LF	5,200	$10.00	$52,000.00
12" BORE AND ENCASE	LF	300	$120.00	$36,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE A-1				$108,000.00
			ENGINEERING & CONTINGENCY (20%)	$21,600.00
			TOTAL LINE A-1	$129,600.00
LINE A-2				
6" P.V.C.	LF	2,600	$10.00	$26,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE A-2				$46,000.00
			ENGINEERING & CONTINGENCY (20%)	$9,200.00
			TOTAL LINE A-2	$55,200.00

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 4
TRANSMISSION SYSTEM COST ESTIMATE

DESCRIPTION	UNIT	APPROXIMATE QUANTITY	UNIT PRICE	TOTAL AMOUNT
LINE B				
14" P.V.C.	LF	62,600	$21.00	$1,314,600.00
VALVES	LS	1	$47,500.00	$47,500.00
24" BORE AND ENCASE	LF	120	$240.00	$28,800.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE B				$1,410,900.00
			ENGINEERING & CONTINGENCY (20%)	$282,180.00
			TOTAL LINE B	$1,693,080.00
LINE C				
8" P.V.C.	LF	14,800	$12.00	$177,600.00
VALVES	LS	1	$15,000.00	$15,000.00
12" BORE AND ENCASE	LF	600	$120.00	$72,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
BOOSTER PUMP STATION (.30 M.G.D.)	LS	1	$125,000.00	$125,000.00
SUB - TOTAL LINE C				$409,600.00
			ENGINEERING & CONTINGENCY (20%)	$81,920.00
			TOTAL LINE C	$491,520.00
LINE D				
6" P.V.C.	LF	39,000	$10.00	$390,000.00
VALVES	LS	1	$35,000.00	$35,000.00
SUB - TOTAL LINE D				$425,000.00
			ENGINEERING & CONTINGENCY (20%)	$85,000.00
			TOTAL LINE D	$510,000.00

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 4
TRANSMISSION SYSTEM COST ESTIMATE

DESCRIPTION	UNIT	APPROXIMATE QUANTITY	UNIT PRICE	TOTAL AMOUNT
LINE G				
6" P.V.C.	LF	72,400	$10.00	$724,000.00
VALVES	LS	1	$65,000.00	$65,000.00
10" BORE AND ENCASE	LF	180	$100.00	$18,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
BOOSTER PUMP STATION (.08 M.G.D.)	LS	1	$60,000.00	$60,000.00
SUB - TOTAL LINE G				$887,000.00
			ENGINEERING & CONTINGENCY (20%)	$177,400.00
			TOTAL LINE G	$1,064,400.00
LINE H				
4" P.V.C.	LF	6,200	$7.00	$43,400.00
VALVES	LS	1	$5,000.00	$5,000.00
METER STATION	LS	1	$20,000.00	$20,000.00
SUB - TOTAL LINE H				$68,400.00
			ENGINEERING & CONTINGENCY (20%)	$13,680.00
			TOTAL LINE H	$82,080.00
			ALTERNATIVE NO. 4 TOTAL	$4,652,520.00

Appendix C

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 1

BOSQUE COUNTY WATER STUDY
CITY OF CLIFTON
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.75
TREATMENT PLANT CAPACITY (MGD) = 1.50
MAX. TREATMENT PLANT FLOW (MGD) = CAPACITY * 0.5862 = 0.88
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	17.67	16.59	18.14	21.15	22.32	22.95	30.92	38.13	26.10	22.55	18.68	18.60	273.80
PLANT FLOW (MG)	17.67	16.59	18.14	21.15	22.32	22.95	27.26	27.26	26.10	22.55	18.68	18.60	259.26
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.00	3.66	10.87	0.00	0.00	0.00	0.00	14.54
I. FIXED COST													
A. PLANT DEBT	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$142,008
B. WATER DEBT	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$544,920
C. RAW WATER SUPPLY DEBT	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$27,996
D. TRANSMISSION DEBT	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$148,920
E. PLANT MANAGEMENT	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$65,124
E. MAINTENANCE	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$32,556
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$707	$664	$725	$846	$893	$918	$1,090	$1,090	$1,044	$902	$747	$744	$10,370
B. CHEMICALS	$707	$664	$725	$846	$893	$918	$1,090	$1,090	$1,044	$902	$747	$744	$10,370
C. OPERATIONS	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$44,400
D. TRANSMISSION ENERGY	$884	$830	$907	$1,058	$1,116	$1,148	$1,363	$1,363	$1,305	$1,128	$934	$930	$12,963
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$0	$879	$2,609	$0	$0	$0	$0	$3,489
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$37	$109	$0	$0	$0	$0	$145
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$86,324	$86,184	$86,385	$86,777	$86,929	$87,011	$88,487	$90,289	$87,420	$86,959	$86,455	$86,445	$1,046,209

TOTAL COST/1000 GALLONS = $3.82

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 1

BOSQUE COUNTY WATER STUDY
CITY OF MERIDIAN
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.27
TREATMENT PLANT CAPACITY (MGD) = 1.50
MAX. TREATMENT PLANT FLOW (MGD) = CAPACITY * 0.4138 = 0.62
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	6.36	5.97	6.53	7.61	8.04	8.26	11.13	13.73	9.40	8.12	6.72	6.70	98.57
PLANT FLOW (MG)	6.36	5.97	6.53	7.61	8.04	8.26	11.13	13.73	9.40	8.12	6.72	6.70	98.57
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I. FIXED COST													
A. PLANT DEBT	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$49,896
B. WATER DEBT	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$384,660
C. RAW WATER SUPPLY DEBT	$820	$820	$820	$820	$820	$820	$820	$820	$820	$820	$820	$820	$9,840
D. TRANSMISSION DEBT	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$27,756
E. PLANT MANAGEMENT	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$22,884
E. MAINTENANCE	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$11,436
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$254	$239	$261	$305	$321	$330	$445	$549	$376	$325	$269	$268	$3,943
B. CHEMICALS	$254	$239	$261	$305	$321	$330	$445	$549	$376	$325	$269	$268	$3,943
C. OPERATIONS	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$15,600
D. TRANSMISSION ENERGY	$318	$299	$326	$381	$402	$413	$557	$686	$470	$406	$336	$335	$4,928
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$44,533	$44,482	$44,555	$44,696	$44,751	$44,780	$45,153	$45,490	$44,927	$44,761	$44,580	$44,576	$537,483

TOTAL COST/1000 GALLONS = $5.45

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2

BOSQUE COUNTY WATER STUDY
CITY OF CLIFTON
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.75	
TREATMENT PLANT CAPACITY (MGD) =	2.00	
MAX. TREATMENT PLANT FLOW (MGD) =	0.75	
WATER TREATMENT ENERGY COST =	$0.08	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.03	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	17.67	16.59	18.14	21.15	22.32	22.95	30.92	38.13	26.10	22.55	18.68	18.60	273.80
PLANT FLOW (MG)	17.67	16.59	18.14	21.15	22.32	22.50	23.25	23.25	22.50	22.55	18.68	18.60	247.19
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.45	7.67	14.88	3.60	0.00	0.00	0.00	26.60
I. FIXED COST													
A. PLANT DEBT	$10,482	$10,482	$10,482	$10,482	$10,482	$10,482	$10,482	$10,482	$10,482	$10,482	$10,482	$10,482	$125,784
B. WATER DEBT	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$377,400
C. RAW WATER SUPPLY DEBT	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$18,336
D. TRANSMISSION DEBT	$9,825	$9,825	$9,825	$9,825	$9,825	$9,825	$9,825	$9,825	$9,825	$9,825	$9,825	$9,825	$117,900
E. PLANT MANAGEMENT	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$35,196
E. MAINTENANCE	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$17,604
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$707	$1,327	$1,451	$1,692	$1,786	$1,800	$1,860	$1,860	$1,800	$1,804	$1,494	$1,488	$19,069
B. CHEMICALS	$707	$664	$725	$846	$893	$900	$930	$930	$900	$902	$747	$744	$9,888
C. OPERATIONS	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$24,000
D. TRANSMISSION ENERGY	$884	$498	$544	$634	$670	$675	$698	$698	$675	$677	$560	$558	$7,770
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$108	$1,841	$3,571	$864	$0	$0	$0	$6,385
B. CHEMICALS	$0	$0	$0	$0	$0	$4	$77	$149	$36	$0	$0	$0	$266
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$62,183	$62,374	$62,605	$63,058	$63,233	$63,373	$65,291	$67,093	$64,160	$63,268	$62,686	$62,675	$762,544

TOTAL COST/1000 GALLONS = $2.79

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2

BOSQUE COUNTY WATER STUDY
CITY OF MERIDIAN
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.27
TREATMENT PLANT CAPACITY (MGD) = 2.50
MAX. TREATMENT PLANT FLOW (MGD) = 0.27
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	6.36	5.97	6.53	7.61	8.04	8.26	11.13	13.73	9.40	8.12	6.72	6.70	98.57
PLANT FLOW (MG)	6.36	5.97	6.53	7.61	8.04	8.10	8.37	8.37	8.10	8.12	6.72	6.70	88.99
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.16	2.76	5.36	1.30	0.00	0.00	0.00	9.58
I. FIXED COST													
A. PLANT DEBT	$3.931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$47.172
B. WATER DEBT	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$135,060
C. RAW WATER SUPPLY DEBT	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$6,876
D. TRANSMISSION DEBT	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$24,468
E. PLANT MANAGEMENT	$1,100	$1,100	$1,100	$1,100	$1,100	$1.100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$13,200
E. MAINTENANCE	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$6,600
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$254	$239	$261	$305	$321	$324	$335	$335	$324	$325	$269	$268	$3,560
B. CHEMICALS	$254	$239	$261	$305	$321	$324	$335	$335	$324	$325	$269	$268	$3,560
C. OPERATIONS	$750	$750	$750	$750	$750	$750	$750	$750	$750	$750	$750	$750	$9,000
D. TRANSMISSION ENERGY	$318	$299	$326	$381	$402	$405	$419	$419	$405	$406	$336	$335	$4,449
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$39	$663	$1,286	$311	$0	$0	$0	$2,298
B. CHEMICALS	$0	$0	$0	$0	$0	$2	$28	$54	$13	$0	$0	$0	$96
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$21,225	$21,174	$21.247	$21,388	$21,443	$21,492	$22,177	$22,825	$21,775	$21,453	$21,272	$21,268	$258,936

TOTAL COST/1000 GALLONS = $2.63

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2

BOSQUE COUNTY WATER STUDY
CITY OF VALLEY MILLS
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.23	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.23	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	5.42	5.09	5.56	6.49	6.84	7.04	9.48	11.69	8.00	6.92	5.73	5.70	83.96
PLANT FLOW (MG)	5.42	5.09	5.56	6.49	6.84	6.90	7.13	7.13	6.90	6.92	5.73	5.70	75.81
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.14	2.35	4.56	1.10	0.00	0.00	0.00	8.16
I. FIXED COST													
A. PLANT DEBT	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$37,740
B. WATER DEBT	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$103,284
C. RAW WATER SUPPLY DEBT	$458	$458	$458	$458	$458	$458	$458	$458	$458	$458	$458	$458	$5,496
D. TRANSMISSION DEBT	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$112,236
E. PLANT MANAGEMENT	$880	$880	$880	$880	$880	$880	$880	$880	$880	$880	$880	$880	$10,560
E. MAINTENANCE	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$5,280
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$217	$204	$222	$259	$274	$276	$285	$285	$276	$277	$229	$228	$3,032
B. CHEMICALS	$217	$204	$222	$259	$274	$276	$285	$285	$276	$277	$229	$228	$3,032
C. OPERATIONS	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$7,200
D. TRANSMISSION ENERGY	$271	$254	$278	$324	$342	$345	$357	$357	$345	$346	$286	$285	$3,790
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$33	$565	$1,095	$265	$0	$0	$0	$1,958
B. CHEMICALS	$0	$0	$0	$0	$0	$1	$24	$46	$11	$0	$0	$0	$82
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$24,387	$24,344	$24,406	$24,526	$24,573	$24,615	$25,198	$25,751	$24,856	$24,582	$24,428	$24,425	$296,258

TOTAL COST/1000 GALLONS = $3.53

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2

BOSQUE COUNTY WATER STUDY
CITY OF IREDELL
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.07
TREATMENT PLANT CAPACITY (MGD) = 2.50
MAX. TREATMENT PLANT FLOW (MGD) = 0.07
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	1.65	1.55	1.69	1.97	2.08	2.14	2.89	3.56	2.44	2.10	1.74	1.74	25.55
PLANT FLOW (MG)	1.65	1.55	1.69	1.97	2.08	2.10	2.17	2.17	2.10	2.10	1.74	1.74	23.07
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.04	0.72	1.39	0.34	0.00	0.00	0.00	2.48
I. FIXED COST													
A. PLANT DEBT	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$12,576
B. WATER DEBT	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$35,748
C. RAW WATER SUPPLY DEBT	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$1,836
D. TRANSMISSION DEBT	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$55,632
E. PLANT MANAGEMENT	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$3,516
E. MAINTENANCE	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$1,764
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$66	$62	$68	$79	$83	$84	$87	$87	$84	$84	$70	$69	$923
B. CHEMICALS	$66	$62	$68	$79	$83	$84	$87	$87	$84	$84	$70	$69	$923
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
D. TRANSMISSION ENERGY	$82	$77	$85	$99	$104	$105	$109	$109	$105	$105	$87	$87	$1,154
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$10	$172	$333	$81	$0	$0	$0	$596
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$7	$14	$3	$0	$0	$0	$25
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$9,870	$9,857	$9,876	$9,913	$9,927	$9,940	$10,117	$10,285	$10,013	$9,930	$9,883	$9,882	$119,543

TOTAL COST/1000 GALLONS = $4.68

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2

BOSQUE COUNTY WATER STUDY
CITY OF WALNUT SPRINGS
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.11	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.11	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	2.59	2.43	2.66	3.10	3.27	3.37	4.54	5.59	3.83	3.31	2.74	2.73	40.16
PLANT FLOW (MG)	2.59	2.43	2.66	3.10	3.27	3.30	3.41	3.41	3.30	3.31	2.74	2.73	36.25
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.07	1.13	2.18	0.53	0.00	0.00	0.00	3.90
I. FIXED COST													
A. PLANT DEBT	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$18,864
B. WATER DEBT	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$55,620
C. RAW WATER SUPPLY DEBT	$229	$229	$229	$229	$229	$229	$229	$229	$229	$229	$229	$229	$2,748
D. TRANSMISSION DEBT	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$45,300
E. PLANT MANAGEMENT	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$5,280
E. MAINTENANCE	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$2,640
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$104	$97	$106	$124	$131	$132	$136	$136	$132	$132	$110	$109	$1,450
B. CHEMICALS	$104	$97	$106	$124	$131	$132	$136	$136	$132	$132	$110	$109	$1,450
C. OPERATIONS	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$3,600
D. TRANSMISSION ENERGY	$130	$122	$133	$155	$164	$165	$171	$171	$165	$165	$137	$136	$1,813
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$16	$270	$524	$127	$0	$0	$0	$936
B. CHEMICALS	$0	$0	$0	$0	$0	$1	$11	$22	$5	$0	$0	$0	$39
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$11,708	$11,687	$11,717	$11,774	$11,797	$11,817	$12,096	$12,360	$11,932	$11,801	$11,727	$11,726	$142,221

TOTAL COST/1000 GALLONS = $3.54

W A T E R S U P P L Y S Y S T E M
A L T E R N A T I V E N O. 2

BOSQUE COUNTY WATER STUDY
CITY OF MORGAN
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.08	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.08	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	1.88	1.77	1.93	2.26	2.38	2.45	3.30	4.07	2.78	2.41	1.99	1.98	29.20
PLANT FLOW (MG)	1.88	1.77	1.93	2.26	2.38	2.40	2.48	2.48	2.40	2.41	1.99	1.98	26.37
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.05	0.82	1.59	0.38	0.00	0.00	0.00	2.84
I. FIXED COST													
A. PLANT DEBT	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$12,576
B. WATER DEBT	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$43,704
C. RAW WATER SUPPLY DEBT	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$1,836
D. TRANSMISSION DEBT	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$31,392
E. PLANT MANAGEMENT	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$3,516
E. MAINTENANCE	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$1,764
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$75	$71	$77	$90	$95	$96	$99	$99	$96	$96	$80	$79	$1,055
B. CHEMICALS	$75	$71	$77	$90	$95	$96	$99	$99	$96	$96	$80	$79	$1,055
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
D. TRANSMISSION ENERGY	$94	$88	$97	$113	$119	$120	$124	$124	$120	$120	$100	$99	$1,318
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$12	$196	$381	$92	$0	$0	$0	$681
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$8	$16	$4	$0	$0	$0	$28
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$8,544	$8,529	$8,550	$8,592	$8,609	$8,623	$8,826	$9,018	$8,707	$8,612	$8,558	$8,557	$103,784

TOTAL COST/1000 GALLONS = $3.55

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2

BOSQUE COUNTY WATER STUDY
CITY OF CRANFILLS GAP
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.06	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.06	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	1.41	1.33	1.45	1.69	1.79	1.84	2.47	3.05	2.09	1.80	1.49	1.49	21.90
PLANT FLOW (MG)	1.41	1.33	1.45	1.69	1.79	1.80	1.86	1.86	1.80	1.80	1.49	1.49	19.78
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.04	0.61	1.19	0.29	0.00	0.00	0.00	2.13
I. FIXED COST													
A. PLANT DEBT	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$9,432
B. WATER DEBT	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$31,776
C. RAW WATER SUPPLY DEBT	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$1,380
D. TRANSMISSION DEBT	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$97,560
E. PLANT MANAGEMENT	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$2,640
E. MAINTENANCE	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$1,320
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$57	$53	$58	$68	$71	$72	$74	$74	$72	$72	$60	$60	$791
B. CHEMICALS	$57	$53	$58	$68	$71	$72	$74	$74	$72	$72	$60	$60	$791
C. OPERATIONS	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$1,800
D. TRANSMISSION ENERGY	$71	$66	$73	$85	$89	$90	$93	$93	$90	$90	$75	$74	$989
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$9	$147	$286	$69	$0	$0	$0	$511
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$6	$12	$3	$0	$0	$0	$21
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$12,543	$12,532	$12,548	$12,579	$12,591	$12,602	$12,754	$12,898	$12,665	$12,594	$12,553	$12,552	$151,455

TOTAL COST/1000 GALLONS = $6.91

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2

BOSQUE COUNTY WATER STUDY
CHILDRESS CREEK WATER SUPPLY CORP.
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.24	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.24	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	5.65	5.31	5.80	6.77	7.14	7.34	9.90	12.20	8.35	7.22	5.98	5.95	87.61
PLANT FLOW (MG)	5.65	5.31	5.80	6.77	7.14	7.20	7.44	7.44	7.20	7.22	5.98	5.95	79.10
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.14	2.46	4.76	1.15	0.00	0.00	0.00	8.51
I. FIXED COST													
A. PLANT DEBT	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$40,884
B. WATER DEBT	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$119,172
C. RAW WATER SUPPLY DEBT	$497	$497	$497	$497	$497	$497	$497	$497	$497	$497	$497	$497	$5,964
D. TRANSMISSION DEBT	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$67,992
E. PLANT MANAGEMENT	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$11,436
E. MAINTENANCE	$477	$477	$477	$477	$477	$477	$477	$477	$477	$477	$477	$477	$5,724
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$226	$212	$232	$271	$286	$288	$298	$298	$288	$289	$239	$238	$3,164
B. CHEMICALS	$226	$212	$232	$271	$286	$288	$298	$298	$288	$289	$239	$238	$3,164
C. OPERATIONS	$650	$650	$650	$650	$650	$650	$650	$650	$650	$650	$650	$650	$7,800
D. TRANSMISSION ENERGY	$283	$265	$290	$338	$357	$360	$372	$372	$360	$361	$299	$298	$3,955
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$35	$589	$1,143	$276	$0	$0	$0	$2,043
B. CHEMICALS	$0	$0	$0	$0	$0	$1	$25	$48	$12	$0	$0	$0	$85
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$22,516	$22,471	$22,535	$22,661	$22,710	$22,753	$23,362	$23,939	$23,005	$22,719	$22,558	$22,555	$273,959

TOTAL COST/1000 GALLONS = $3.13

W A T E R S U P P L Y S Y S T E M
A L T E R N A T I V E N O. 2

BOSQUE COUNTY WATER STUDY
MUSTANG WATER SUPPLY CORP.
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.05	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.05	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	1.18	1.11	1.21	1.41	1.49	1.53	2.06	2.54	1.74	1.50	1.25	1.24	18.25
PLANT FLOW (MG)	1.18	1.11	1.21	1.41	1.49	1.50	1.55	1.55	1.50	1.50	1.25	1.24	16.48
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.03	0.51	0.99	0.24	0.00	0.00	0.00	1.77
I. FIXED COST													
A. PLANT DEBT	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$9,432
B. WATER DEBT	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$27,804
C. RAW WATER SUPPLY DEBT	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$1,380
D. TRANSMISSION DEBT	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$14,724
E. PLANT MANAGEMENT	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$2,640
E. MAINTENANCE	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$1,320
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$47	$44	$48	$56	$60	$60	$62	$62	$60	$60	$50	$50	$659
B. CHEMICALS	$47	$44	$48	$56	$60	$60	$62	$62	$60	$60	$50	$50	$659
C. OPERATIONS	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$1,800
D. TRANSMISSION ENERGY	$59	$55	$60	$71	$74	$75	$78	$78	$75	$75	$62	$62	$824
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$7	$123	$238	$58	$0	$0	$0	$426
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$5	$10	$2	$0	$0	$0	$18
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$5,278	$5,269	$5,282	$5,308	$5,318	$5,328	$5,454	$5,575	$5,380	$5,320	$5,287	$5,286	$64,122

TOTAL COST/1000 GALLONS = $3.51

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 3

BOSQUE COUNTY WATER STUDY
CITY OF CLIFTON
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.75
TREATMENT PLANT CAPACITY (MGD) = 1.50
MAX. TREATMENT PLANT FLOW (MGD) = CAPACITY * 0.5862 = 0.88
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	17.67	16.59	18.14	21.15	22.32	22.95	30.92	38.13	26.10	22.55	18.68	18.60	273.80
PLANT FLOW (MG)	17.67	16.59	18.14	21.15	22.32	22.95	27.28	27.28	26.10	22.55	18.68	18.60	259.30
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.00	3.64	10.85	0.00	0.00	0.00	0.00	14.49
I. FIXED COST													
A. PLANT DEBT	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$142,008
B. WATER DEBT	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$544,920
C. RAW WATER SUPPLY DEBT	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$33,528
D. TRANSMISSION DEBT	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$203,076
E. PLANT MANAGEMENT	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$65,124
E. MAINTENANCE	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$32,556
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$707	$664	$725	$846	$893	$918	$1,091	$1,091	$1,044	$902	$747	$744	$10,372
B. CHEMICALS	$707	$664	$725	$846	$893	$918	$1,091	$1,091	$1,044	$902	$747	$744	$10,372
C. OPERATIONS	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$44,400
D. TRANSMISSION ENERGY	$884	$830	$907	$1,058	$1,116	$1,148	$1,364	$1,364	$1,305	$1,128	$934	$930	$12,965
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$0	$874	$2,604	$0	$0	$0	$0	$3,478
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$36	$108	$0	$0	$0	$0	$145
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$91,298	$91,158	$91,359	$91,751	$91,903	$91,985	$93,458	$95,260	$92,394	$91,933	$91,429	$91,419	$1,105,892

TOTAL COST/1000 GALLONS = $4.04

W A T E R S U P P L Y S Y S T E M
A L T E R N A T I V E N O. 3

BOSQUE COUNTY WATER STUDY
CITY OF MERIDIAN
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.27
TREATMENT PLANT CAPACITY (MGD) = 1.50
MAX. TREATMENT PLANT FLOW (MGD) = CAPACITY * 0.4138 = 0.62
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	6.36	5.97	6.53	7.61	8.04	8.26	11.13	13.73	9.40	8.12	6.72	6.70	98.57
PLANT FLOW (MG)	6.36	5.97	6.53	7.61	8.04	8.26	11.13	13.73	9.40	8.12	6.72	6.70	98.57
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I. FIXED COST													
A. PLANT DEBT	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$49,896
B. WATER DEBT	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$384,660
C. RAW WATER SUPPLY DEBT	$982	$982	$982	$982	$982	$982	$982	$982	$982	$982	$982	$982	$11,784
D. TRANSMISSION DEBT	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$39,660
E. PLANT MANAGEMENT	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$22,884
E. MAINTENANCE	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$11,436
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$254	$239	$261	$305	$321	$330	$445	$549	$376	$325	$269	$268	$3,943
B. CHEMICALS	$254	$239	$261	$305	$321	$330	$445	$549	$376	$325	$269	$268	$3,943
C. OPERATIONS	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$15,600
D. TRANSMISSION ENERGY	$318	$299	$326	$381	$402	$413	$557	$686	$470	$406	$336	$335	$4,928
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$45,687	$45,636	$45,709	$45,850	$45,905	$45,934	$46,307	$46,644	$46,081	$45,915	$45,734	$45,730	$551,331

TOTAL COST/1000 GALLONS = $5.59

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 4

BOSQUE COUNTY WATER STUDY
CITY OF CLIFTON
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS. TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.75	
TREATMENT PLANT CAPACITY (MGD) =	2.00	
MAX. TREATMENT PLANT FLOW (MGD) =	0.75	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	17.67	16.59	18.14	21.15	22.32	22.95	30.92	38.13	26.10	22.55	18.68	18.60	273.80
PLANT FLOW (MG)	17.67	16.59	18.14	21.15	22.32	22.50	23.25	23.25	22.50	22.55	18.68	18.60	247.19
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.45	7.67	14.88	3.60	0.00	0.00	0.00	26.60
I. FIXED COST													
A. PLANT DEBT	$11.317	$11,317	$11,317	$11,317	$11,317	$11,317	$11.317	$11,317	$11,317	$11,317	$11,317	$11,317	$135,804
B. WATER DEBT	$40,659	$40,659	$40.659	$40,659	$40,659	$40,659	$40,659	$40,659	$40,659	$40,659	$40,659	$40,659	$487,908
C. RAW WATER SUPPLY DEBT	$1.801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$21,612
D. TRANSMISSION DEBT	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$146,028
E. PLANT MANAGEMENT	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$45,756
E. MAINTENANCE	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$22,884
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$707	$664	$725	$846	$893	$900	$930	$930	$900	$902	$747	$744	$9,888
B. CHEMICALS	$707	$664	$725	$846	$893	$900	$930	$930	$900	$902	$747	$744	$9,888
C. OPERATIONS	$2.600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$31,200
D. TRANSMISSION ENERGY	$884	$830	$907	$1,058	$1,116	$1,125	$1,163	$1,163	$1,125	$1,128	$934	$930	$12,360
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$108	$1,841	$3,571	$864	$0	$0	$0	$6,385
B. CHEMICALS	$0	$0	$0	$0	$0	$4	$77	$149	$36	$0	$0	$0	$266
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$76.763	$76.623	$76,824	$77,216	$77.368	$77.504	$79,407	$81,209	$78,291	$77,398	$76,894	$76,884	$932,925

TOTAL COST/1000 GALLONS = $3.41

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 4

BOSQUE COUNTY WATER STUDY
CITY OF MERIDIAN
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.27	
TREATMENT PLANT CAPACITY (MGD) =	2.00	
MAX. TREATMENT PLANT FLOW (MGD) =	0.27	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	6.36	5.97	6.53	7.61	8.04	8.26	11.13	13.73	9.40	8.12	6.72	6.70	98.57
PLANT FLOW (MG)	6.36	5.97	6.53	7.61	8.04	8.10	8.37	8.37	8.10	8.12	6.72	6.70	88.99
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.16	2.76	5.36	1.30	0.00	0.00	0.00	9.58
I. FIXED COST													
A. PLANT DEBT	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$49,620
B. WATER DEBT	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$174,612
C. RAW WATER SUPPLY DEBT	$658	$658	$658	$658	$658	$658	$658	$658	$658	$658	$658	$658	$7,896
D. TRANSMISSION DEBT	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$27,552
E. PLANT MANAGEMENT	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$16,716
E. MAINTENANCE	$697	$697	$697	$697	$697	$697	$697	$697	$697	$697	$697	$697	$8,364
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$254	$239	$261	$305	$321	$324	$335	$335	$324	$325	$269	$268	$3,560
B. CHEMICALS	$254	$239	$261	$305	$321	$324	$335	$335	$324	$325	$269	$268	$3,560
C. OPERATIONS	$950	$950	$950	$950	$950	$950	$950	$950	$950	$950	$950	$950	$11,400
D. TRANSMISSION ENERGY	$318	$299	$326	$381	$402	$405	$419	$419	$405	$406	$336	$335	$4,449
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$39	$663	$1,286	$311	$0	$0	$0	$2,298
B. CHEMICALS	$0	$0	$0	$0	$0	$2	$28	$54	$13	$0	$0	$0	$96
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$25,707	$25,656	$25,729	$25,870	$25,925	$25,974	$26,659	$27,307	$26,257	$25,935	$25,754	$25,750	$312,720

TOTAL COST/1000 GALLONS = $3.17

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 4

BOSQUE COUNTY WATER STUDY
CITY OF WALNUT SPRINGS
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.11
TREATMENT PLANT CAPACITY (MGD) = 2.00
MAX. TREATMENT PLANT FLOW (MGD) = 0.11
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	2.59	2.43	2.66	3.10	3.27	3.37	4.54	5.59	3.83	3.31	2.74	2.73	40.16
PLANT FLOW (MG)	2.59	2.43	2.66	3.10	3.27	3.30	3.41	3.41	3.30	3.31	2.74	2.73	36.25
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.07	1.13	2.18	0.53	0.00	0.00	0.00	3.90
I. FIXED COST													
A. PLANT DEBT	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$20,892
B. WATER DEBT	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$71,904
C. RAW WATER SUPPLY DEBT	$277	$277	$277	$277	$277	$277	$277	$277	$277	$277	$277	$277	$3,324
D. TRANSMISSION DEBT	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$45,300
E. PLANT MANAGEMENT	$587	$587	$587	$587	$587	$587	$587	$587	$587	$587	$587	$587	$7,044
E. MAINTENANCE	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$3,516
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$104	$97	$106	$124	$131	$132	$136	$136	$132	$132	$110	$109	$1,450
B. CHEMICALS	$104	$97	$106	$124	$131	$132	$136	$136	$132	$132	$110	$109	$1,450
C. OPERATIONS	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$4,800
D. TRANSMISSION ENERGY	$130	$122	$133	$155	$164	$165	$171	$171	$165	$165	$137	$136	$1,813
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$16	$270	$524	$127	$0	$0	$0	$936
B. CHEMICALS	$0	$0	$0	$0	$0	$1	$11	$22	$5	$0	$0	$0	$39
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$13,602	$13,581	$13,611	$13,668	$13,691	$13,711	$13,990	$14,254	$13,826	$13,695	$13,621	$13,620	$164,949

TOTAL COST/1000 GALLONS = $4.11

W A T E R   S U P P L Y   S Y S T E M
A L T E R N A T I V E   N O. 4

BOSQUE COUNTY WATER STUDY
CITY OF CRANFILLS GAP
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.06	
TREATMENT PLANT CAPACITY (MGD) =	2.00	
MAX. TREATMENT PLANT FLOW (MGD) =	0.06	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	1.41	1.33	1.45	1.69	1.79	1.84	2.47	3.05	2.09	1.80	1.49	1.49	21.90
PLANT FLOW (MG)	1.41	1.33	1.45	1.69	1.79	1.80	1.86	1.86	1.80	1.80	1.49	1.49	19.78
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.04	0.61	1.19	0.29	0.00	0.00	0.00	2.13
I. FIXED COST													
A. PLANT DEBT	$870	$870	$870	$870	$870	$870	$870	$870	$870	$870	$870	$870	$10,440
B. WATER DEBT	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$41,088
C. RAW WATER SUPPLY DEBT	$139	$139	$139	$139	$139	$139	$139	$139	$139	$139	$139	$139	$1,668
D. TRANSMISSION DEBT	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$97,332
E. PLANT MANAGEMENT	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$3,516
E. MAINTENANCE	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$1,764
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$57	$53	$58	$68	$71	$72	$74	$74	$72	$72	$60	$60	$791
B. CHEMICALS	$57	$53	$58	$68	$71	$72	$74	$74	$72	$72	$60	$60	$791
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
D. TRANSMISSION ENERGY	$71	$66	$73	$85	$89	$90	$93	$93	$90	$90	$75	$74	$989
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$9	$147	$286	$69	$0	$0	$0	$511
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$6	$12	$3	$0	$0	$0	$21
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$13,568	$13,557	$13,573	$13,604	$13,616	$13,627	$13,779	$13,923	$13,690	$13,619	$13,578	$13,577	$163,755

TOTAL COST/1000 GALLONS = $7.48

W A T E R   S U P P L Y   S Y S T E M
A L T E R N A T I V E   N O. 4

BOSQUE COUNTY WATER STUDY
CHILDRESS CREEK WATER SUPPLY CORP.
YEAR 2000

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.24	
TREATMENT PLANT CAPACITY (MGD) =	2.00	
MAX. TREATMENT PLANT FLOW (MGD) =	0.24	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	5.65	5.31	5.80	6.77	7.14	7.34	9.90	12.20	8.35	7.22	5.98	5.95	87.61
PLANT FLOW (MG)	5.65	5.31	5.80	6.77	7.14	7.20	7.44	7.44	7.20	7.22	5.98	5.95	79.10
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.14	2.46	4.76	1.15	0.00	0.00	0.00	8.51
I. FIXED COST													
A. PLANT DEBT	$3.700	$3,700	$3.700	$3.700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3.700	$3,700	$44,400
B. WATER DEBT	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$154,080
C. RAW WATER SUPPLY DEBT	$589	$589	$589	$589	$589	$589	$589	$589	$589	$589	$589	$589	$7,068
D. TRANSMISSION DEBT	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$97,068
E. PLANT MANAGEMENT	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$14,964
E. MAINTENANCE	$623	$623	$623	$623	$623	$623	$623	$623	$623	$623	$623	$623	$7,476
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$226	$212	$232	$271	$286	$288	$298	$298	$288	$289	$239	$238	$3.164
B. CHEMICALS	$226	$212	$232	$271	$286	$288	$298	$298	$288	$289	$239	$238	$3.164
C. OPERATIONS	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850	$10,200
D. TRANSMISSION ENERGY	$283	$265	$290	$338	$357	$360	$372	$372	$360	$361	$299	$298	$3,955
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$35	$589	$1,143	$276	$0	$0	$0	$2,043
B. CHEMICALS	$0	$0	$0	$0	$0	$1	$25	$48	$12	$0	$0	$0	$85
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$28.873	$28.828	$28.892	$29,018	$29,067	$29.110	$29,719	$30,296	$29,362	$29,076	$28,915	$28.912	$350,243

TOTAL COST/1000 GALLONS = $4.00

Appendix D

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 1

BOSQUE COUNTY WATER STUDY
CITY OF CLIFTON
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.95		
TREATMENT PLANT CAPACITY (MGD) =	1.50		
MAX. TREATMENT PLANT FLOW (MGD) =	CAPACITY *	0.5862 =	0.88
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.	
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.	
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.	
WELL ENERGY COST =	$0.24	/1000 GAL.	
WELL CHEMICALS COST =	$0.01	/1000 GAL.	

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	22.38	21.01	22.97	26.79	28.27	29.07	39.17	48.30	33.06	28.57	23.65	23.56	346.81
PLANT FLOW (MG)	22.38	21.01	22.97	26.40	27.28	26.40	27.28	27.28	26.40	27.28	23.65	23.56	301.90
WELL FLOW (MG)	0.00	0.00	0.00	0.39	0.99	2.67	11.89	21.02	6.66	1.29	0.00	0.00	44.90
I. FIXED COST													
A. PLANT DEBT	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$142,008
B. WATER DEBT	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$544,920
C. RAW WATER SUPPLY DEBT	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$2,333	$27,996
D. TRANSMISSION DEBT	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$12,410	$148,920
E. PLANT MANAGEMENT	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$65,124
E. MAINTENANCE	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$32,556
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$895	$841	$919	$1,056	$1,091	$1,056	$1,091	$1,091	$1,056	$1,091	$946	$942	$12,076
B. CHEMICALS	$895	$841	$919	$1,056	$1,091	$1,056	$1,091	$1,091	$1,056	$1,091	$946	$942	$12,076
C. OPERATIONS	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$44,400
D. TRANSMISSION ENERGY	$1,119	$1,051	$1,149	$1,320	$1,364	$1,320	$1,364	$1,364	$1,320	$1,364	$1,183	$1,178	$15,095
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$94	$238	$641	$2,853	$5,044	$1,598	$309	$0	$0	$10,777
B. CHEMICALS	$0	$0	$0	$4	$10	$27	$119	$210	$67	$13	$0	$0	$449
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$86,937	$86,759	$87,013	$87,557	$87,821	$88,127	$90,546	$92,828	$89,124	$87,895	$87,102	$87,090	$1,059,491

TOTAL COST/1000 GALLONS = $3.05

W A T E R S U P P L Y S Y S T E M
A L T E R N A T I V E N O. 1

BOSQUE COUNTY WATER STUDY
CITY OF MERIDIAN
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.34
TREATMENT PLANT CAPACITY (MGD) = 1.50
MAX. TREATMENT PLANT FLOW (MGD) = CAPACITY * 0.4138 = 0.53
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	8.01	7.52	8.22	9.59	10.12	10.40	14.02	17.29	11.83	10.22	8.47	8.43	124.12
PLANT FLOW (MG)	8.01	7.52	8.22	9.59	10.12	10.40	14.02	16.43	11.83	10.22	8.47	8.43	123.26
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00	0.86
I. FIXED COST													
A. PLANT DEBT	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$49,896
B. WATER DEBT	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$384,660
C. RAW WATER SUPPLY DEBT	$820	$820	$820	$820	$820	$820	$820	$820	$820	$820	$820	$820	$9,840
D. TRANSMISSION DEBT	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$2,313	$27,756
E. PLANT MANAGEMENT	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$22,884
E. MAINTENANCE	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$11,436
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$320	$301	$329	$384	$405	$416	$561	$657	$473	$409	$339	$337	$4,931
B. CHEMICALS	$320	$301	$329	$384	$405	$416	$561	$657	$473	$409	$339	$337	$4,931
C. OPERATIONS	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$15,600
D. TRANSMISSION ENERGY	$401	$376	$411	$479	$506	$520	$701	$822	$592	$511	$423	$422	$6,163
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$0	$0	$205	$0	$0	$0	$0	$205
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$0	$9	$0	$0	$0	$0	$9
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$44,747	$44,684	$44,775	$44,952	$45,021	$45,059	$45,528	$46,056	$45,244	$45,035	$44,807	$44,802	$540,959

TOTAL COST/1000 GALLONS = $4.36

W A T E R   S U P P L Y   S Y S T E M
A L T E R N A T I V E   N O. 2

BOSQUE COUNTY WATER STUDY
CITY OF CLIFTON
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.95	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.95	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	22.38	21.01	22.97	26.79	28.27	29.07	39.17	48.30	33.06	28.57	23.65	23.56	346.81
PLANT FLOW (MG)	22.38	21.01	22.97	26.79	28.27	28.50	29.45	29.45	28.50	28.57	23.65	23.56	313.11
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.57	9.72	18.85	4.56	0.00	0.00	0.00	33.70
I. FIXED COST													
A. PLANT DEBT	$10.482	$10.482	$10.482	$10.482	$10.482	$10,482	$10,482	$10,482	$10,482	$10,482	$10,482	$10,482	$125,784
B. WATER DEBT	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$31,450	$377,400
C. RAW WATER SUPPLY DEBT	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$1,528	$18,336
D. TRANSMISSION DEBT	$9.825	$9,825	$9,825	$9.825	$9,825	$9,825	$9,825	$9,825	$9,825	$9,825	$9,825	$9,825	$117,900
E. PLANT MANAGEMENT	$2.933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$2,933	$35,196
E. MAINTENANCE	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$1,467	$17,604
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$895	$841	$919	$1,072	$1,131	$1,140	$1,178	$1,178	$1,140	$1,143	$946	$942	$12,524
B. CHEMICALS	$895	$841	$919	$1,072	$1,131	$1,140	$1,178	$1,178	$1,140	$1,143	$946	$942	$12,524
C. OPERATIONS	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$24,000
D. TRANSMISSION ENERGY	$1,119	$1,051	$1,149	$1,339	$1,414	$1,425	$1,473	$1,473	$1,425	$1,428	$1,183	$1,178	$15,656
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$137	$2,332	$4,524	$1,094	$0	$0	$0	$8,087
B. CHEMICALS	$0	$0	$0	$0	$0	$6	$97	$188	$46	$0	$0	$0	$337
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$62,795	$62,617	$62,871	$63,368	$63,560	$63,733	$66,143	$68,426	$64,730	$63,599	$62,960	$62,948	$768,442

TOTAL COST/1000 GALLONS = $2.22

W A T E R   S U P P L Y   S Y S T E M
A L T E R N A T I V E   N O. 2

BOSQUE COUNTY WATER STUDY
CITY OF MERIDIAN
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.34	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.34	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	8.01	7.52	8.22	9.59	10.12	10.40	14.02	17.29	11.83	10.22	8.47	8.43	124.12
PLANT FLOW (MG)	8.01	7.52	8.22	9.59	10.12	10.20	10.54	10.54	10.20	10.22	8.47	8.43	112.06
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.20	3.48	6.75	1.63	0.00	0.00	0.00	12.06
I. FIXED COST													
A. PLANT DEBT	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$3,931	$47,172
B. WATER DEBT	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$11,255	$135,060
C. RAW WATER SUPPLY DEBT	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$573	$6,876
D. TRANSMISSION DEBT	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$2,039	$24,468
E. PLANT MANAGEMENT	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$13,200
E. MAINTENANCE	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$6,600
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$320	$301	$329	$384	$405	$408	$422	$422	$408	$409	$339	$337	$4,482
B. CHEMICALS	$320	$301	$329	$384	$405	$408	$422	$422	$408	$409	$339	$337	$4,482
C. OPERATIONS	$750	$750	$750	$750	$750	$750	$750	$750	$750	$750	$750	$750	$9,000
D. TRANSMISSION ENERGY	$401	$376	$411	$479	$506	$510	$527	$527	$510	$511	$423	$422	$5,603
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$49	$835	$1,619	$392	$0	$0	$0	$2,894
B. CHEMICALS	$0	$0	$0	$0	$0	$2	$35	$67	$16	$0	$0	$0	$121
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$21,439	$21,376	$21,467	$21,644	$21,713	$21,775	$22,638	$23,455	$22,132	$21,727	$21,499	$21,494	$262,607

TOTAL COST/1000 GALLONS = $2.12

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2

BOSQUE COUNTY WATER STUDY
CITY OF VALLEY MILLS
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.26	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.26	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	6.13	5.75	6.29	7.33	7.74	7.96	10.72	13.22	9.05	7.82	6.47	6.45	94.92
PLANT FLOW (MG)	6.13	5.75	6.29	7.33	7.74	7.80	8.06	8.06	7.80	7.82	6.47	6.45	85.69
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.16	2.66	5.16	1.25	0.00	0.00	0.00	9.22
I. FIXED COST													
A. PLANT DEBT	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$3,145	$37,740
B. WATER DEBT	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$8,607	$103,284
C. RAW WATER SUPPLY DEBT	$458	$458	$458	$458	$458	$458	$458	$458	$458	$458	$458	$458	$5,496
D. TRANSMISSION DEBT	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$9,353	$112,236
E. PLANT MANAGEMENT	$880	$880	$880	$880	$880	$880	$880	$880	$880	$880	$880	$880	$10,560
E. MAINTENANCE	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$5,280
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$245	$230	$251	$293	$310	$312	$322	$322	$312	$313	$259	$258	$3,428
B. CHEMICALS	$245	$230	$251	$293	$310	$312	$322	$322	$312	$313	$259	$258	$3,428
C. OPERATIONS	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$7,200
D. TRANSMISSION ENERGY	$306	$288	$314	$367	$387	$390	$403	$403	$390	$391	$324	$322	$4,285
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$37	$638	$1,238	$300	$0	$0	$0	$2,213
B. CHEMICALS	$0	$0	$0	$0	$0	$2	$27	$52	$12	$0	$0	$0	$92
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$24,479	$24,431	$24,500	$24,636	$24,689	$24,736	$25,396	$26,020	$25,009	$24,699	$24,525	$24,521	$297,832

TOTAL COST/1000 GALLONS = $3.14

W A T E R   S U P P L Y   S Y S T E M
A L T E R N A T I V E   N O. 2

BOSQUE COUNTY WATER STUDY
CITY OF IREDELL
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.09	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.09	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	2.12	1.99	2.18	2.54	2.68	2.75	3.71	4.58	3.13	2.71	2.24	2.23	32.86
PLANT FLOW (MG)	2.12	1.99	2.18	2.54	2.68	2.70	2.79	2.79	2.70	2.71	2.24	2.23	29.66
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.05	0.92	1.79	0.43	0.00	0.00	0.00	3.19
I. FIXED COST													
A. PLANT DEBT	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$12,576
B. WATER DEBT	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$2,979	$35,748
C. RAW WATER SUPPLY DEBT	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$1,836
D. TRANSMISSION DEBT	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$4,636	$55,632
E. PLANT MANAGEMENT	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$3,516
E. MAINTENANCE	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$1,764
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$85	$80	$87	$102	$107	$108	$112	$112	$108	$108	$90	$89	$1,187
B. CHEMICALS	$85	$80	$87	$102	$107	$108	$112	$112	$108	$108	$90	$89	$1,187
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
D. TRANSMISSION ENERGY	$106	$100	$109	$127	$134	$135	$140	$140	$135	$135	$112	$112	$1,483
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$13	$221	$429	$104	$0	$0	$0	$766
B. CHEMICALS	$0	$0	$0	$0	$0	$1	$9	$18	$4	$0	$0	$0	$32
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$9,932	$9,915	$9,939	$9,986	$10,004	$10,021	$10,249	$10,465	$10,115	$10,008	$9,947	$9,946	$120,592

TOTAL COST/1000 GALLONS = $3.67

W A T E R S U P P L Y S Y S T E M
A L T E R N A T I V E N O. 2

BOSQUE COUNTY WATER STUDY
CITY OF WALNUT SPRINGS
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.14	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.14	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	3.30	3.10	3.39	3.95	4.17	4.28	5.77	7.12	4.87	4.21	3.49	3.47	
PLANT FLOW (MG)	3.30	3.10	3.39	3.95	4.17	4.20	4.34	4.34	4.20	4.21	3.49	3.47	51.11
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.08	1.43	2.78	0.67	0.00	0.00	0.00	46.14
													4.97
I. FIXED COST													
A. PLANT DEBT	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	$1,572	
B. WATER DEBT	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$4,635	$18,864
C. RAW WATER SUPPLY DEBT	$229	$229	$229	$229	$229	$229	$229	$229	$229	$229	$229	$229	$55,620
D. TRANSMISSION DEBT	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$2,748
E. PLANT MANAGEMENT	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$440	$45,300
E. MAINTENANCE	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$5,280
													$2,640
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$132	$124	$135	$158	$167	$168	$174	$174	$168	$168	$139	$139	
B. CHEMICALS	$132	$124	$135	$158	$167	$168	$174	$174	$168	$168	$139	$139	$1,846
C. OPERATIONS	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$1,846
D. TRANSMISSION ENERGY	$165	$155	$169	$197	$208	$210	$217	$217	$210	$210	$174	$174	$3,600
													$2,307
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$20	$344	$667	$161	$0	$0	$0	
B. CHEMICALS	$0	$0	$0	$0	$0	$1	$14	$28	$7	$0	$0	$0	$1,192
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$50
													$2,400
TOTAL	$11,800	$11,774	$11,811	$11,884	$11,913	$11,938	$12,293	$12,630	$12,085	$11,918	$11,824	$11,822	$143,794

TOTAL COST/1000 GALLONS = $2.81

W A T E R S U P P L Y S Y S T E M
A L T E R N A T I V E N O. 2

BOSQUE COUNTY WATER STUDY
CITY OF MORGAN
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.11	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.11	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	2.59	2.43	2.66	3.10	3.27	3.37	4.54	5.59	3.83	3.31	2.74	2.73	
PLANT FLOW (MG)	2.59	2.43	2.66	3.10	3.27	3.30	3.41	3.41	3.30	3.31	2.74	2.73	40.16
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.07	1.13	2.18	0.53	0.00	0.00	0.00	36.25
													3.90
I. FIXED COST													
A. PLANT DEBT	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	$1,048	
B. WATER DEBT	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$3,642	$12,576
C. RAW WATER SUPPLY DEBT	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$153	$43,704
D. TRANSMISSION DEBT	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$2,616	$1,836
E. PLANT MANAGEMENT	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$31,392
E. MAINTENANCE	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$3,516
													$1,764
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$104	$97	$106	$124	$131	$132	$136	$136	$132	$132	$110	$109	
B. CHEMICALS	$104	$97	$106	$124	$131	$132	$136	$136	$132	$132	$110	$109	$1,450
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$1,450
D. TRANSMISSION ENERGY	$130	$122	$133	$155	$164	$165	$171	$171	$165	$165	$137	$136	$2,400
													$1,813
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$16	$270	$524	$127	$0	$0	$0	
B. CHEMICALS	$0	$0	$0	$0	$0	$1	$11	$22	$5	$0	$0	$0	$936
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$39
													$2,400
TOTAL	$8,636	$8,615	$8,645	$8,702	$8,725	$8,745	$9,024	$9,288	$8,860	$8,729	$8,655	$8,654	$105,357

TOTAL COST/1000 GALLONS = $2.62

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2

BOSQUE COUNTY WATER STUDY
CITY OF CRANFILLS GAP
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
21-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.08	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.08	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	1.88	1.77	1.93	2.26	2.38	2.45	3.30	4.07	2.78	2.41	1.99	1.98	29.20
PLANT FLOW (MG)	1.88	1.77	1.93	2.26	2.38	2.40	2.48	2.48	2.40	2.41	1.99	1.98	26.37
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.05	0.82	1.59	0.38	0.00	0.00	0.00	2.84
I. FIXED COST													
A. PLANT DEBT	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$9,432
B. WATER DEBT	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$2,648	$31,776
C. RAW WATER SUPPLY DEBT	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$1,380
D. TRANSMISSION DEBT	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$8,130	$97,560
E. PLANT MANAGEMENT	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$2,640
E. MAINTENANCE	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$1,320
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$75	$71	$77	$90	$95	$96	$99	$99	$96	$96	$80	$79	$1,055
B. CHEMICALS	$75	$71	$77	$90	$95	$96	$99	$99	$96	$96	$80	$79	$1,055
C. OPERATIONS	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$1,800
D. TRANSMISSION ENERGY	$94	$88	$97	$113	$119	$120	$124	$124	$120	$120	$100	$99	$1,318
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$12	$196	$381	$92	$0	$0	$0	$681
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$8	$16	$4	$0	$0	$0	$28
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$12,604	$12,589	$12,610	$12,652	$12,669	$12,683	$12,886	$13,078	$12,767	$12,672	$12,618	$12,617	$152,504

TOTAL COST/1000 GALLONS = $5.22

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2

BOSQUE COUNTY WATER STUDY
CHILDRESS CREEK WATER SUPPLY CORP.
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.3	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.30	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	7.07	6.64	7.25	8.46	8.93	9.18	12.37	15.25	10.44	9.02	7.47	7.44	109.52
PLANT FLOW (MG)	7.07	6.64	7.25	8.46	8.93	9.00	9.30	9.30	9.00	9.02	7.47	7.44	98.88
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.18	3.07	5.95	1.44	0.00	0.00	0.00	10.64
I. FIXED COST													
A. PLANT DEBT	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$3,407	$40,884
B. WATER DEBT	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$9,931	$119,172
C. RAW WATER SUPPLY DEBT	$497	$497	$497	$497	$497	$497	$497	$497	$497	$497	$497	$497	$5,964
D. TRANSMISSION DEBT	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$5,666	$67,992
E. PLANT MANAGEMENT	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$11,436
E. MAINTENANCE	$477	$477	$477	$477	$477	$477	$477	$477	$477	$477	$477	$477	$5,724
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$283	$265	$290	$338	$357	$360	$372	$372	$360	$361	$299	$298	$3,955
B. CHEMICALS	$283	$265	$290	$338	$357	$360	$372	$372	$360	$361	$299	$298	$3,955
C. OPERATIONS	$650	$650	$650	$650	$650	$650	$650	$650	$650	$650	$650	$650	$7,800
D. TRANSMISSION ENERGY	$353	$332	$363	$423	$446	$450	$465	$465	$450	$451	$374	$372	$4,944
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$43	$737	$1,428	$346	$0	$0	$0	$2,554
B. CHEMICALS	$0	$0	$0	$0	$0	$2	$31	$60	$14	$0	$0	$0	$106
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$22,700	$22,644	$22,724	$22,881	$22,942	$22,996	$23,757	$24,478	$23,311	$22,954	$22,752	$22,748	$277,105

TOTAL COST/1000 GALLONS = $2.53

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 2

BOSQUE COUNTY WATER STUDY
MUSTANG WATER SUPPLY CORP.
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.07	
TREATMENT PLANT CAPACITY (MGD) =	2.50	
MAX. TREATMENT PLANT FLOW (MGD) =	0.07	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	1.65	1.55	1.69	1.97	2.08	2.14	2.89	3.56	2.44	2.10	1.74	1.74	25.55
PLANT FLOW (MG)	1.65	1.55	1.69	1.97	2.08	2.10	2.17	2.17	2.10	2.10	1.74	1.74	23.07
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.04	0.72	1.39	0.34	0.00	0.00	0.00	2.48
I. FIXED COST													
A. PLANT DEBT	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$786	$9,432
B. WATER DEBT	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$2,317	$27,804
C. RAW WATER SUPPLY DEBT	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$115	$1,380
D. TRANSMISSION DEBT	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$1,227	$14,724
E. PLANT MANAGEMENT	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$220	$2,640
E. MAINTENANCE	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$110	$1,320
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$66	$62	$68	$79	$83	$84	$87	$87	$84	$84	$70	$69	$923
B. CHEMICALS	$66	$62	$68	$79	$83	$84	$87	$87	$84	$84	$70	$69	$923
C. OPERATIONS	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$1,800
D. TRANSMISSION ENERGY	$82	$77	$85	$99	$104	$105	$109	$109	$105	$105	$87	$87	$1,154
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$10	$172	$333	$81	$0	$0	$0	$596
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$7	$14	$3	$0	$0	$0	$25
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$5,339	$5,326	$5,345	$5,382	$5,396	$5,409	$5,586	$5,754	$5,482	$5,399	$5,352	$5,351	$65,171

TOTAL COST/1000 GALLONS = $2.55

W A T E R S U P P L Y S Y S T E M
A L T E R N A T I V E N O. 3

BOSQUE COUNTY WATER STUDY
CITY OF CLIFTON
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.95
TREATMENT PLANT CAPACITY (MGD) = 1.50
MAX. TREATMENT PLANT FLOW (MGD) = CAPACITY * 0.5862 = 0.88
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	22.38	21.01	22.97	26.79	28.27	29.07	39.17	48.30	33.06	28.57	23.65	23.56	346.81
PLANT FLOW (MG)	22.38	21.01	22.97	26.40	27.28	26.40	27.28	27.28	26.40	27.28	23.65	23.56	301.90
WELL FLOW (MG)	0.00	0.00	0.00	0.39	0.99	2.67	11.89	21.02	6.66	1.29	0.00	0.00	44.90
I. FIXED COST													
A. PLANT DEBT	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$11,834	$142,008
B. WATER DEBT	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$45,410	$544,920
C. RAW WATER SUPPLY DEBT	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$2,794	$33,528
D. TRANSMISSION DEBT	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$16,923	$203,076
E. PLANT MANAGEMENT	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$5,427	$65,124
E. MAINTENANCE	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$2,713	$32,556
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$895	$841	$919	$1,056	$1,091	$1,056	$1,091	$1,091	$1,056	$1,091	$946	$942	$12,076
B. CHEMICALS	$895	$841	$919	$1,056	$1,091	$1,056	$1,091	$1,091	$1,056	$1,091	$946	$942	$12,076
C. OPERATIONS	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$44,400
D. TRANSMISSION ENERGY	$1,119	$1,051	$1,149	$1,320	$1,364	$1,320	$1,364	$1,364	$1,320	$1,364	$1,183	$1,178	$15,095
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$94	$238	$641	$2,853	$5,044	$1,598	$309	$0	$0	$10,777
B. CHEMICALS	$0	$0	$0	$4	$10	$27	$119	$210	$67	$13	$0	$0	$449
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$91,911	$91,733	$91,987	$92,531	$92,795	$93,101	$95,520	$97,802	$94,098	$92,869	$92,076	$92,064	$1,119,179

TOTAL COST/1000 GALLONS = $3.23

W A T E R   S U P P L Y   S Y S T E M
A L T E R N A T I V E   N O. 3

BOSQUE COUNTY WATER STUDY
CITY OF MERIDIAN
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.34
TREATMENT PLANT CAPACITY (MGD) = 1.50
MAX. TREATMENT PLANT FLOW (MGD) = CAPACITY * 0.4138 = 0.62
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	8.01	7.52	8.22	9.59	10.12	10.40	14.02	17.29	11.83	10.22	8.47	8.43	124.12
PLANT FLOW (MG)	8.01	7.52	8.22	9.59	10.12	10.40	14.02	17.29	11.83	10.22	8.47	8.43	124.12
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I. FIXED COST													
A. PLANT DEBT	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$4,158	$49,896
B. WATER DEBT	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$32,055	$384,660
C. RAW WATER SUPPLY DEBT	$982	$982	$982	$982	$982	$982	$982	$982	$982	$982	$982	$982	$11,784
D. TRANSMISSION DEBT	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$3,305	$39,660
E. PLANT MANAGEMENT	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$22,884
E. MAINTENANCE	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$953	$11,436
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$320	$301	$329	$384	$405	$416	$561	$691	$473	$409	$339	$337	$4,965
B. CHEMICALS	$320	$301	$329	$384	$405	$416	$561	$691	$473	$409	$339	$337	$4,965
C. OPERATIONS	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$15,600
D. TRANSMISSION ENERGY	$401	$376	$411	$479	$506	$520	$701	$864	$592	$511	$423	$422	$6,206
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$45,901	$45,838	$45,929	$46,106	$46,175	$46,213	$46,682	$47,107	$46,398	$46,189	$45,961	$45,956	$554,704

TOTAL COST/1000 GALLONS = $4.47

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 4

BOSQUE COUNTY WATER STUDY
CITY OF CLIFTON
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.95	
TREATMENT PLANT CAPACITY (MGD) =	2.00	
MAX. TREATMENT PLANT FLOW (MGD) =	0.95	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	22.38	21.01	22.97	26.79	28.27	29.07	39.17	48.30	33.06	28.57	23.65	23.56	346.81
PLANT FLOW (MG)	22.38	21.01	22.97	26.79	28.27	28.50	29.45	29.45	28.50	28.57	23.65	23.56	313.11
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.57	9.72	18.85	4.56	0.00	0.00	0.00	33.70
I. FIXED COST													
A. PLANT DEBT	$11,317	$11,317	$11,317	$11,317	$11,317	$11,317	$11,317	$11,317	$11,317	$11,317	$11,317	$11,317	$135,804
B. WATER DEBT	$40,659	$40,659	$40,659	$40,659	$40,659	$40,659	$40,659	$40,659	$40,659	$40,659	$40,659	$40,659	$487,908
C. RAW WATER SUPPLY DEBT	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$1,801	$21,612
D. TRANSMISSION DEBT	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$12,169	$146,028
E. PLANT MANAGEMENT	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$3,813	$45,756
E. MAINTENANCE	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$1,907	$22,884
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$895	$841	$919	$1,072	$1,131	$1,140	$1,178	$1,178	$1,140	$1,143	$946	$942	$12,524
B. CHEMICALS	$895	$841	$919	$1,072	$1,131	$1,140	$1,178	$1,178	$1,140	$1,143	$946	$942	$12,524
C. OPERATIONS	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$2,600	$31,200
D. TRANSMISSION ENERGY	$1,119	$1,051	$1,149	$1,339	$1,414	$1,425	$1,473	$1,473	$1,425	$1,428	$1,183	$1,178	$15,656
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$137	$2,332	$4,524	$1,094	$0	$0	$0	$8,087
B. CHEMICALS	$0	$0	$0	$0	$0	$6	$97	$188	$46	$0	$0	$0	$337
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$77,376	$77,198	$77,452	$77,949	$78,141	$78,314	$80,724	$83,007	$79,311	$78,180	$77,541	$77,529	$943,414

TOTAL COST/1000 GALLONS = $2.72

W A T E R S U P P L Y S Y S T E M
A L T E R N A T I V E N O. 4

BOSQUE COUNTY WATER STUDY
CITY OF MERIDIAN
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.34
TREATMENT PLANT CAPACITY (MGD) = 2.00
MAX. TREATMENT PLANT FLOW (MGD) = 0.34
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	8.01	7.52	8.22	9.59	10.12	10.40	14.02	17.29	11.83	10.22	8.47	8.43	124.12
PLANT FLOW (MG)	8.01	7.52	8.22	9.59	10.12	10.20	10.54	10.54	10.20	10.22	8.47	8.43	112.06
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.20	3.48	6.75	1.63	0.00	0.00	0.00	12.06
I. FIXED COST													
A. PLANT DEBT	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$4,135	$49,620
B. WATER DEBT	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$14,551	$174,612
C. RAW WATER SUPPLY DEBT	$658	$658	$658	$658	$658	$658	$658	$658	$658	$658	$658	$658	$7,896
D. TRANSMISSION DEBT	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$2,296	$27,552
E. PLANT MANAGEMENT	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$1,393	$16,716
E. MAINTENANCE	$697	$697	$697	$697	$697	$697	$697	$697	$697	$697	$697	$697	$8,364
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$320	$301	$329	$384	$405	$408	$422	$422	$408	$409	$339	$337	$4,482
B. CHEMICALS	$320	$301	$329	$384	$405	$408	$422	$422	$408	$409	$339	$337	$4,482
C. OPERATIONS	$950	$950	$950	$950	$950	$950	$950	$950	$950	$950	$950	$950	$11,400
D. TRANSMISSION ENERGY	$401	$376	$411	$479	$506	$510	$527	$527	$510	$511	$423	$422	$5,603
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$49	$835	$1,619	$392	$0	$0	$0	$2,894
B. CHEMICALS	$0	$0	$0	$0	$0	$2	$35	$67	$16	$0	$0	$0	$121
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$25,921	$25,858	$25,949	$26,126	$26,195	$26,257	$27,120	$27,937	$26,614	$26,209	$25,981	$25,976	$316,391

TOTAL COST/1000 GALLONS = $2.55

W A T E R S U P P L Y S Y S T E M
A L T E R N A T I V E N O. 4

BOSQUE COUNTY WATER STUDY
CITY OF WALNUT SPRINGS
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) = 0.14
TREATMENT PLANT CAPACITY (MGD) = 2.00
MAX. TREATMENT PLANT FLOW (MGD) = 0.14
WATER TREATMENT ENERGY COST = $0.04 /1000 GAL.
WATER TREATMENT CHEMICALS COST = $0.04 /1000 GAL.
TRANSMISSION ENERGY COST = $0.05 /1000 GAL.
WELL ENERGY COST = $0.24 /1000 GAL.
WELL CHEMICALS COST = $0.01 /1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	3.30	3.10	3.39	3.95	4.17	4.28	5.77	7.12	4.87	4.21	3.49	3.47	51.11
PLANT FLOW (MG)	3.30	3.10	3.39	3.95	4.17	4.20	4.34	4.34	4.20	4.21	3.49	3.47	46.14
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.08	1.43	2.78	0.67	0.00	0.00	0.00	4.97
I. FIXED COST													
A. PLANT DEBT	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$1,741	$20,892
B. WATER DEBT	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$5,992	$71,904
C. RAW WATER SUPPLY DEBT	$277	$277	$277	$277	$277	$277	$277	$277	$277	$277	$277	$277	$3,324
D. TRANSMISSION DEBT	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$3,775	$45,300
E. PLANT MANAGEMENT	$587	$587	$587	$587	$587	$587	$587	$587	$587	$587	$587	$587	$7,044
E. MAINTENANCE	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$3,516
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$132	$124	$135	$158	$167	$168	$174	$174	$168	$168	$139	$139	$1,846
B. CHEMICALS	$132	$124	$135	$158	$167	$168	$174	$174	$168	$168	$139	$139	$1,846
C. OPERATIONS	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$4,800
D. TRANSMISSION ENERGY	$165	$155	$169	$197	$208	$210	$217	$217	$210	$210	$174	$174	$2,307
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$20	$344	$667	$161	$0	$0	$0	$1,192
B. CHEMICALS	$0	$0	$0	$0	$0	$1	$14	$28	$7	$0	$0	$0	$50
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$13,694	$13,668	$13,705	$13,778	$13,807	$13,832	$14,187	$14,524	$13,979	$13,812	$13,718	$13,716	$166,522

TOTAL COST/1000 GALLONS = $3.26

W A T E R S U P P L Y S Y S T E M
A L T E R N A T I V E N O. 4

BOSQUE COUNTY WATER STUDY
CITY OF CRANFILLS GAP
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.08	
TREATMENT PLANT CAPACITY (MGD) =	2.00	
MAX. TREATMENT PLANT FLOW (MGD) =	0.08	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	1.88	1.77	1.93	2.26	2.38	2.45	3.30	4.07	2.78	2.41	1.99	1.98	29.20
PLANT FLOW (MG)	1.88	1.77	1.93	2.26	2.38	2.40	2.48	2.48	2.40	2.41	1.99	1.98	26.37
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.05	0.82	1.59	0.38	0.00	0.00	0.00	2.84
I. FIXED COST													
A. PLANT DEBT	$870	$870	$870	$870	$870	$870	$870	$870	$870	$870	$870	$870	$10,440
B. WATER DEBT	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$3,424	$41,088
C. RAW WATER SUPPLY DEBT	$139	$139	$139	$139	$139	$139	$139	$139	$139	$139	$139	$139	$1,668
D. TRANSMISSION DEBT	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$8,111	$97,332
E. PLANT MANAGEMENT	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$293	$3,516
E. MAINTENANCE	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$147	$1,764
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$75	$71	$77	$90	$95	$96	$99	$99	$96	$96	$80	$79	$1,055
B. CHEMICALS	$75	$71	$77	$90	$95	$96	$99	$99	$96	$96	$80	$79	$1,055
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
D. TRANSMISSION ENERGY	$94	$88	$97	$113	$119	$120	$124	$124	$120	$120	$100	$99	$1,318
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$12	$196	$381	$92	$0	$0	$0	$681
B. CHEMICALS	$0	$0	$0	$0	$0	$0	$8	$16	$4	$0	$0	$0	$28
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$13,629	$13,614	$13,635	$13,677	$13,694	$13,708	$13,911	$14,103	$13,792	$13,697	$13,643	$13,642	$164,804

TOTAL COST/1000 GALLONS = $5.64

WATER SUPPLY SYSTEM
ALTERNATIVE NO. 4

BOSQUE COUNTY WATER STUDY
CHILDRESS CREEK WATER SUPPLY CORP.
YEAR 2020

DANNENBAUM ENGINEERING CORP.

DALLAS, TEXAS
22-Dec-89

ANNUAL AVERAGE DAY DEMAND (MGD) =	0.30	
TREATMENT PLANT CAPACITY (MGD) =	2.00	
MAX. TREATMENT PLANT FLOW (MGD) =	0.30	
WATER TREATMENT ENERGY COST =	$0.04	/1000 GAL.
WATER TREATMENT CHEMICALS COST =	$0.04	/1000 GAL.
TRANSMISSION ENERGY COST =	$0.05	/1000 GAL.
WELL ENERGY COST =	$0.24	/1000 GAL.
WELL CHEMICALS COST =	$0.01	/1000 GAL.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
FLOW MULTIPLIER	0.76	0.79	0.78	0.94	0.96	1.02	1.33	1.64	1.16	0.97	0.83	0.80	
MONTHLY FLOW (MG)	7.07	6.64	7.25	8.46	8.93	9.18	12.37	15.25	10.44	9.02	7.47	7.44	109.52
PLANT FLOW (MG)	7.07	6.64	7.25	8.46	8.93	9.00	9.30	9.30	9.00	9.02	7.47	7.44	98.88
WELL FLOW (MG)	0.00	0.00	0.00	0.00	0.00	0.18	3.07	5.95	1.44	0.00	0.00	0.00	10.64
I. FIXED COST													
A. PLANT DEBT	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$3,700	$44,400
B. WATER DEBT	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$12,840	$154,080
C. RAW WATER SUPPLY DEBT	$589	$589	$589	$589	$589	$589	$589	$589	$589	$589	$589	$589	$7,068
D. TRANSMISSION DEBT	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$8,089	$97,068
E. PLANT MANAGEMENT	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$1,247	$14,964
E. MAINTENANCE	$623	$623	$623	$623	$623	$623	$623	$623	$623	$623	$623	$623	$7,476
II. WATER TREATMENT VARIABLE COST													
A. PLANT ENERGY	$283	$265	$290	$338	$357	$360	$372	$372	$360	$361	$299	$298	$3,955
B. CHEMICALS	$283	$265	$290	$338	$357	$360	$372	$372	$360	$361	$299	$298	$3,955
C. OPERATIONS	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850	$850	$10,200
D. TRANSMISSION ENERGY	$353	$332	$363	$423	$446	$450	$465	$465	$450	$451	$374	$372	$4,944
III. WELL VARIABLE COST													
A. ENERGY	$0	$0	$0	$0	$0	$43	$737	$1,428	$346	$0	$0	$0	$2,554
B. CHEMICALS	$0	$0	$0	$0	$0	$2	$31	$60	$14	$0	$0	$0	$106
C. OPERATIONS	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$2,400
TOTAL	$29,057	$29,001	$29,081	$29,238	$29,299	$29,353	$30,114	$30,835	$29,668	$29,311	$29,109	$29,105	$353,389

TOTAL COST/1000 GALLONS = $3.23