Region G 2006 Regional Water Plan Amendments -Contents

- Cleburne Plan Amendment
- Somervell Plan Amendment
- Somervell Steam Electric Plan Amendment
- Turkey Peak Reservoir Plan Amendment

Request for Amendment to the Region G Water Plan to Add Development of the City of Cleburne Water Supply Projects to Meet Projected Water Supply Shortages

1. Background

The *2006 Brazos G Regional Water Plan* recommended two water management strategies. They are conservation and reuse. The City will continue to pursue both of these strategies.

The City commissioned a long-range water supply study that was completed in January 2008. The study showed that the City of Cleburne may have significant increases in industrial demand over the next few years which were not identified in the 2006 Brazos G Regional Water Plan, in particular:

- Brazos Electric Power Company has indicated that they intend to construct Phase II of their existing power plant in Cleburne in the 2013 to 2015 period. This would increase Cleburne's average-day demand by 1.1 to 2.2 MGD, depending on the Phase II unit capacity.
- Representatives of the oil and gas industry have asked Cleburne for water to develop natural gas wells. They are seeking an average of 1.5 MGD for the next few years, with lower amounts needed in the future.
- Other industries currently located in Cleburne have indicated that they expect significant increases in their demands, and the City continues to attract new industries as well.

Municipal demands are also increasing due to growing population. This growth in demand requires that Cleburne develop substantial new supplies in the next few years.

The recommended plan developed in the January 2008 study addressed both the immediate additional water needs and a long-term sustainable supply. The major components of the plan are:

- Optimization of the surface water supplies from Lake Pat Cleburne and Lake Aquilla through planned expansions of the City's existing water treatment plant;
- Maintaining the groundwater for supplemental and peak usage;
- Expanding the reuse wastewater facilities for industrial applications;
- Developing Lake Whitney as a long-term sustainable water supply for the City;

- Continuing the City's Water Conservation Program to preserve water resources.

The Texas Water Development Board at a funding pre-application meeting on April 14, 2008 determined that the water treatment plant expansion and developing Lake Whitney as a long-term sustainable water supply for the City of Cleburne are not specifically included in the 2006 Brazos G Regional Water Plan and thus are not currently eligible for Water Infrastructure funding. Following the April 14, 2008 meeting the City of Cleburne requested that the Brazos G Regional Water Planning Group amend the 2006 Brazos G Regional Water Plan to add the water treatment plant expansion and development of Lake Whitney BRA contracted water supply.

2. Amendment Request

The City of Cleburne respectfully requests that the *2006 Brazos G Regional Water Plan* be amended to add the following City of Cleburne's water management strategies, which include:

- Develop the New West Loop Reclaimed Water Line (reuse of wastewater) and Pump Station. This project would develop a reclaimed water pipeline on the west side of the City, which would join the existing east reclaimed water line serving the Brazos Electric Power Plant (Steam Electric) to form a looped system. This line would supply reclaimed water for oil and gas development (Mining), irrigation use by major water users, and industrial use (Manufacturing) by the existing James Hardie manufacturing plant and others. This project would supply the City of Cleburne and Johnson County mining, manufacturing, steam electric and irrigation water through Cleburne. While an expanded reuse program is identified for Cleburne, this project is not specifically identified as a water management strategy for the City in the 2006 Brazos G Regional Water Plan.
- Complete a 5 MGD expansion of the existing water treatment plant. This project would increase the capacity of the existing water treatment plant to meet projected peak-day needs and to supply treated water from existing and future raw water supply sources. This project would supply the City of Cleburne and Johnson County mining, manufacturing, steam electric and irrigation water through Cleburne.
- Complete the 1.9 MGD Phase I Lake Whitney Water Supply Project. This project would develop part of Cleburne's remaining contractual commitment for water from

the Brazos River Authority (beyond the 4.73 MGD [5,300 acre-feet per year] currently available from Lake Aquilla). The project would require a deep water intake, diversion pump station to take water out of Lake Whitney, an advanced water treatment facility for the Lake Whitney water, blending tanks, a booster pump station, and a pipeline to connect the Lake Whitney supply to the existing Barkman Pipeline for delivery to Cleburne, and all associated appurtenances for a fully functional and operational water supply delivery and treatment system. This project would supply the City of Cleburne and Johnson County mining, manufacturing, steam electric and irrigation water through Cleburne.

The City believes that this amendment meets the Texas Water Development Board criteria for a minor amendment to the *2006 Brazos G Regional Water Plan*, as laid out in Texas Administrative Code Rule 357.16:

- It does not result in over allocation of an existing or planned source of water. The amendment does not change the allocation of any source of supply. The project develops, in phases, the current BRA contracted amount of 9,700 acre-feet per year and does not rely on any new allocations.
- It does not relate to a new reservoir. The amendment only relates to the development of treatment and transmission facilities.
- It does not have a significant impact on instream flows, environmental flows, or freshwater flows to bays and estuaries.
- It does not have a significant impact on water planning or previously adopted management strategies.
- It does not delete or change any legal requirements of the plan.

If the Brazos G Regional Planning Group or the Texas Water Development Board determines that the requested amendment cannot be processed as a minor amendment, the City requests that it be processed as a major amendment.

3. Description of Strategy

The City of Cleburne currently obtains its water supply from four sources:

- Lake Pat Cleburne;
- Lake Aquilla and the associated Barkman Pipeline;

- Seven groundwater wells in the Trinity Sands Aquifer;
- Direct reuse of treated wastewater for industrial supplies.

The main source of Cleburne's existing water supply is Lake Pat Cleburne which has 5,760 acre-feet per year of adjudicated municipal water rights. The certificate of adjudication was amended in January 2002 to authorize the City to use the bed and banks of Lake Pat Cleburne to deliver 5,300 acre-feet per year of water from Lake Aquilla and 4,700 acre-feet per year of water from Lake Whitney.

It is estimated that the yield of Lake Pat Cleburne will decrease by about 0.29 MGD between 2006 to the year 2050.

The supply available from Lake Aquilla may decrease significantly over the same period. If the yield of Lake Aquilla decreases as indicated by recent BRA analysis, Cleburne (and other holders of contracts for water from the Lake) will not be able to divert the full contracted amount as a reliable supply.

Annual Average Day Supply Capability of the Existing Water Sources

	2006 (MGD)	**2050 (MGD**
Lake Pat Cleburne	4.66	4.38
Lake Aquilla (BRA Contract)	4.73	3.57
Groundwater	1.0	1.0
Direct Reuse of Treated Wastewater	0.6	5.0

The current existing water supply is 10.98 MGD and the current projected drought condition demand is 11.38 MGD.

To meet the existing and long-term water supply need it will be necessary to develop the Lake Whitney BRA contracted water supply. Cleburne has an existing contract with BRA for use of as much as 15,000 acre-feet per year of water from the Brazos River Authority. BRA has indicated that the 15,000 acre-feet per year can be supplied from any part of its system (subject to availability) and Cleburne is currently using 5,300 acre-feet per year from Lake Aquilla.

Based on preliminary examination of the Lake Whitney reservoir topography, an intake and pump station from Lake Whitney could be located on the eastern shore of the lake. Other

diversion locations may be evaluated and other future take points identified. Lake Whitney water would be treated at an advanced water treatment plant located on the eastern shore. The water would not be disinfected to meet drinking water standards, but the TDS and chlorides would be reduced to match the target water quality in Lake Pat Cleburne and Lake Aquilla. The partially treated water would then be blended with Lake Aquilla water in the Barkman pipeline and pumped to the City's treatment plant or Lake Pat Cleburne for rediversion and treatment. Future options may include full treatment at the take point.

4. Available Supply

The City of Cleburne has a water right for 5,760 acre-feet per year for municipal use and 240 acre-feet per year for irrigation from Lake Pat Cleburne. The City has contracted for 15,000 acre-feet from BRA of which 5,300 acre-feet per year is supplied from Lake Aquilla and the remaining 9,700 acre-feet per year will be supplied from Lake Whitney. The proposed project which is the subject of this amendment will make this 9,700 acre-feet per year available as a reliable water supply for the City of Cleburne.

Environmental

Environmental impacts could include:

- Possible minor impacts on riparian corridors, depending on location of connecting pipelines and treatment plant.
- Other possible minor impacts from pipeline construction. The impacts of pipeline development will be minimized to the extent possible by following existing roadway corridors and by avoiding environmentally sensitive areas where feasible.
- Intake and Pump Station could potentially have Section 404 permit environmental considerations from the Corps of Engineers regarding construction disturbance of Lake Whitney. All necessary permits and environmental documentation will be acquired.

A summary of environmental issues is presented in Table 1.

Table 1
Environmental Issues:
City of Cleburne Water Supply Project

Water Management Option	Cleburne Water Supply Project
Implementation Measures	Expand the existing water treatment plant by 5 MGD, construction of a Lake Whitney Pump Station, advanced treatment plant and pipeline.
Environmental Water Needs/Instream Flows	Negligible impact.
Bays and Estuaries	Negligible impact.
Fish and Wildlife Habitat	Possible minor impacts on riparian corridors, depending on specific location of pipelines, possible minor impact on aquatic life from lake pump station.
Cultural Resources	Possible low impact.
Threatened and Endangered Species	Possible low impact.

5. Engineering and Costing

Figures 1 and 2 show the facilities required to develop the City of Cleburne Water Project. Water from Lake Whitney will be treated at an advanced water treatment plant on the eastern shore and blended to a target level. The brine waste will be disposed of in a TCEQ permitted Class I disposal well, other options for brine disposal may be evaluated. The blended water will be pumped to the Barkman pipeline and diverted to the City's water treatment plant or Lake Pat Cleburne.

Table 2 summarizes the capital costs for Phase I of the project.

Table 2
Cost Estimate Summary for City of Cleburne
Water Supply Project
(2007 Prices)

LAKE WHITNEY DIVERSION – TDS SCALPING OPTION
(PHASE I)

	Item Description	Units/Size	Unit Price ($ 2007)	Estimated Amount ($2007)	Estimated Amount ($2002)
	Capital Costs:				
1.	Deep Water Intake	Platform Design		$ 11,750,000	$ 10,138,000
2.	Raw Water Pump Station	4.2 MGD	4,700 ac.ft./yr.	Included in Item #1	
3.	Electrical Service	1000 Hp	LS	$ 1,750,000	$ 1,509,900
4.	Feed Tank	0.5 MG		$ 300,000	$ 258,800
5.	Pre-Treatment – MF/UF	1.75 MGD		$ 1,750,000	$ 1,509,900
6.	Transfer Tank	0.5 MG		$ 300,000	$ 258,800
7.	Desalination Treatment – RO	1.75 MGD		$ 2,500,000	$ 2,157,000
8.	Transfer Tank	0.5 MG		$ 300,000	$ 258,800
9.	Chemical Facilities and Administration	1.9 MGD		$ 225,000	$ 194,100
10.	Transfer Pumps	1.9 MGD		$ 475,000	$ 409,800
11.	Concentrate Disposal	0.50 MGD			$ 1,509,900
	Brine Concentrator		LS	$ 1,750,000	$ 1,509,900
	Disposal Well		LS	$ 1,750,000	
12.	Transmission Pipeline	8 miles/18 inch	$95/ft	$ 4,012,800	$ 3,462,300
13.	Meters and Connections	LS		$ 50,000	$ 43,100
14.	Land Acquisition	10 Acres	$25,000/Ac	$ 250,000	$ 215,700
15.	Easements	30 ft. wide	$0.21660/SF	$ 274,476	$ 236,800
16.	Permitting				
	404 Permit (Individual Permit)			$ 90,000	$ 77,700
	Mitigation			$ 150,000	$ 129,400
	Threatened/Endangered species habitat assessment			$ 10,000	$ 8,600
	Cultural resources survey			$ 20,000	$ 17,300
	Environmental Assessment for 404 Permit			$ 250,000	$ 215,700
	Archaeological Assessment			$ 75,000	$ 64,700
	TPWD Sand, Gravel, & Marl Permit			$ 10,000	$ 8,600
	GLO Grant of Easement			$ 15,000	$ 12,900
	Permitting “Bed and Banks” through Lake Pat Cleburne			$ 85,000	$ 73,300
	TCEQ Disposal Well Class I Permit			$ 250,000	$ 215,700
	Sub-Total			$ 28,392,276	$ 24,497,200
17.	Engineering, Legal and Contingencies	30%		$ 8,517,683	$ 7,349,200
	Total Capital Cost			**$ 36,909,958**	**$ 31,846,400**
	Annual Costs				
1.	Debt Service (5.50 percent, 20 years)			$ 3,088,625	$ 2,664,900
2.	Raw Water Purchase (20 year present worth)			$ 271,425	$ 234,200
3.	Operation and Maintenance				
	Pump Station & Transmission			$ 415,297	$ 358,300
	Water Treatment			$ 1,416,656	$ 1,222,300
4.	Brine Disposal			$ 198,332	$ 171,100
5.	Pumping			$ 45,491	$ 39,300
	Total Annual Phase I			**$ 5,435,826**	**$ 4,690,100**
	Cost per 1000 Gallons Phase I			**$ 7.84**	**$ 6.76**
	Cost per Acre-Ft. Phase I			**$ 2,554.10**	**$ 2,204**
	Treated Water Produced Phase I			**1.9 MGD**	**1.9 MGD**

Note : 2007 Costs were reduced to 2002 Costs using 3 % Inflation per year over 5 years.

Table 2 (Continued)
Cost Estimate Summary for City of Cleburne
5 MGD Water Treatment Plant Expansion
(2007 Prices)

WATER TREATMENT PLANT EXPANSION – 5 MGD

Item Description	Units/Size	Unit Price	Estimated Amount ($ 2007)	Estimated Amount ($ 2002)
Capital Costs:				
1. Water Treatment Plant Expansion	5 MGD	LS	$ 8,000,000	$ 6,902,500
2. Improvements to Sludge Handling	5 MGD	LS	$ 750,000	$ 647,100
3. Miscellaneous Improvements & Pumping		LS	$ 500,000	$ 431,400
Sub-Total			**$ 9,250,000**	**$ 7,981,000**
Engineering, Legal & Contingencies		**30%**	**$ 2,775,000**	**$ 2,394,300**
Total			**$ 12,025,000**	**$ 10,375,300**
Unit Cost @2.5 MGD Average: $/1000 gallons			**$1.98**	**$ 1.71**
Unit Cost $ per gallon capacity			**$2.41**	**$ 2.08**

Note: 2007 Costs were reduced to 2002 Costs using 3% Inflation per year over 5 years.

Table 2 (Continued)
Cost Estimate Summary for City of Cleburne
New West Loop Reuse Pipeline
(2007 Prices)

WASTEWATER REUSE

New West Loop Reuse Line
New 16" direct wastewater reuse line from WWTP west and looping to meet existing line at Brazos Electric.
Reuse water could be provided for irrigation to Municipal Golf Course (beyond 24 acre-feet from Lake Pat Cleburne).
Hill County College, Walls Hospital and a substantial volume to James Hardie.

Construction Items	Total Units	Unit Cost(s)	2007 Cost	2002 Cost
New 16" reuse pipeline	56505	$ 95	$ 5,367,975	$ 4,631,600
Pump Station – Installed	1	$ 450,000	$ 450,000	$ 388,300
Meter	1	$ 50,000	$ 50,000	$ 43,100
Storage Tank – standpipe	1	$ 400,000	$ 400,000	$ 431,400
Easements	30' Wide	$ 6.50	$ 339,030	$ 292,500
Sub-Total			**$ 6,607,005**	**$ 5,700,600**
Engineering & Contingencies (@30% of sub-total			$ 1,982,102	$ 1,710,200
Total Capital Cost			**$ 8,559,107**	**$ 7,384,900**
Debt Service 20 years @ 5.5 %			$ 716,200	$ 618,000

Annual Pumping Cost	Unit Cost(s)	Total Units	2007 Cost	2002 Cost
1.5 MGD @ 500 TDH, 200 Hp	$0.09 Per kW-H	1,307,000 kW-H	$ 117,630	$ 101,500
Annual O&M Cost				
1% of Pipeline Cost (Includes Chlorine & Normal)	$64,416	1	$ 64,416	$ 55,600
2.5% of Pump Station Cost	$13,500	1	$ 13,500	$ 11,600
Total O&M cost			$ 77,916	$ 67,200
Total Annual Cost (Capital + O&M)			**$ 989,662**	**$ 853,900**
Cost/1000 gallons (Based on 1.5MGD)			**$1.81**	**$ 1.56**

Note : 2007 Costs were reduced to 2002 Costs using 3% Inflation per year over 5 years.

Table 3 summarizes the capital costs for the recommended short-term Water Supply Projects for Cleburne.

Table 3
Recommended Short-Term Projects for Cleburne

Project Description	Estimated Supply (MGD)	Estimated Capital Cost
West Side Reuse Line and Pump Station	2.4	$8,600,000
5 MGD Water Treatment Plant Expansion	-	$12,025,000
1.9 MGD Lake Whitney project Phase I	1.9	$36,910,000
TOTAL	4.3	$57,535,000

Table 3 shows the estimated cost of each of these projects and the supply available from them. The three projects would supply a total of about 4.3 mgd for Cleburne (although supplies from the reuse pipeline would continue to grow over time), and the total estimated capital cost (at 2007 prices) is $57,535,000.

Cleburne will also have to develop additional supplies to meet long-term demands beyond 2020. At this time, it is not clear what Cleburne's best options to meet demands beyond 2020 will be, but the following steps could meet currently forecast demands:

- Complete Water Treatment Plant expansions as needed (5 MGD expansions forecast for 2024, 2034, 2043 and 2050)
- Develop Lake Whitney Phase 2 (2021)
- Develop indirect reuse in Lake Pat Cleburne (2027)
- Develop Lake Whitney Phase 3 or other supply source (2031)

6. Implementation Issues

This project could be developed in cooperation with the Brazos River Authority to provide a regional surface water supply. Other implementation issues will include financing and Section 404 permitting. As shown in Table 4, this water management strategy has been compared to the plan development criteria.

7. Potential Regulatory Requirements

Implementation of this water management strategy will require the following permits for pipeline and lake pump station construction:

- U.S. Army Corps of Engineers Section 404 permit for intake and pipeline stream crossings and discharges of fill into wetlands and waters of the U.S. during construction.
- NPDES Stormwater Pollution Prevention Plans.
- Possibly TP&WD Sand, Shell, Gravel, and Marl permits for construction in state-owned stream beds.

Table 4
Comparison of City of Cleburne Water Supply Project to Plan Development Criteria

Impact category	*Comment(s)*
A. Water Supply	
1. Quantity	1. Sufficient for local needs.
2. Reliability	2. High.
3. Cost	3. Relatively high, but reasonable compared to other similar systems.
B. Environmental Factors	
1. Environmental Water Needs	1. Low impact.
2. Habitat	2. Low impact.
3. Cultural Resources	3. Low impact.
4. Bays and Estuaries	4. Low impact.
5. Threatened and Endangered Species	5. Low impact.
6. Wetlands	6. Low impact.
C. Impact on Other State Water Resources	No apparent negative impacts on state water resources. No effect on navigation.
D. Threats to Agriculture and Natural Resources	None.
E. Equitable Comparison of Strategies Deemed Feasible	Done.
F. Requirements for Interbasin Transfers	Not applicable.
G. Third Party Social and Economic Impacts from Voluntary Redistribution	None.

4C.17.5 City of Cleburne

4C.17.5.1 Description of Supply

The City of Cleburne obtains its water supply from Lake Pat Cleburne, Lake Aquilla, and groundwater from the Trinity Aquifer. The City of Cleburne is projected to have a surplus of 1,791 acft/yr in the year 2030 and a shortage of 2,853 acft/yr in the year 2060.

4C.17.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Cleburne:

- Conservation
- Reuse (The City has implemented a reuse program, which it has committed to expanding.)
- Lake Whitney Supply – The project will develop 9,700 acre-feet per year of undeveloped water supply from Lake Whitney contracted to the City through the Brazos River Authority. This project would develop part of Cleburne's remaining contractual commitment for water from the Brazos river authority, beyond the 5,300 acre-feet per year currently available from Lake Aquilla. The project would require a deep water intake, diversion pump station to take water out of Lake Whitney, an advanced water treatment facility for the Lake Whitney water, blending tanks, a booster pump station , and a pipeline to connect the Lake Whitney supply to the existing Barkman Pipeline for delivery to Cleburne , and all associated appurtenances for a fully functional and operational water supply delivery and treatment system. This project would supply the City of Cleburne and Johnson County mining, manufacturing, steam electric, and irrigation water though Cleburne.
- Optimization of the surface water supplies from Lake Pat Cleburne, Lake Aquilla, Lake Whitney and any other future water supply through planned expansions of the City's existing water treatment plant – The first phase project would expand the existing water treatment plant by 5 MGD to meet projected peak-day needs and to supply treated water to City customers. This project would supply the City of Cleburne and Johnson county mining, manufacturing, steam electric and irrigation water through Cleburne.

4C.17.5.3 Costs

Costs of the Recommended Plan for the City of Cleburne.

a. Conservation
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: $195,700 (maximum annual cost in 2020)

b. Reuse Strategy 1 – Expanded Use of Existing System:
   - Cost Source: Strategy Evaluation (Section 4B.3)
   - Date to be Implemented: before 2010
   - Annual Cost: $1,512,090 (Based on unit costs from Section 4B.3)

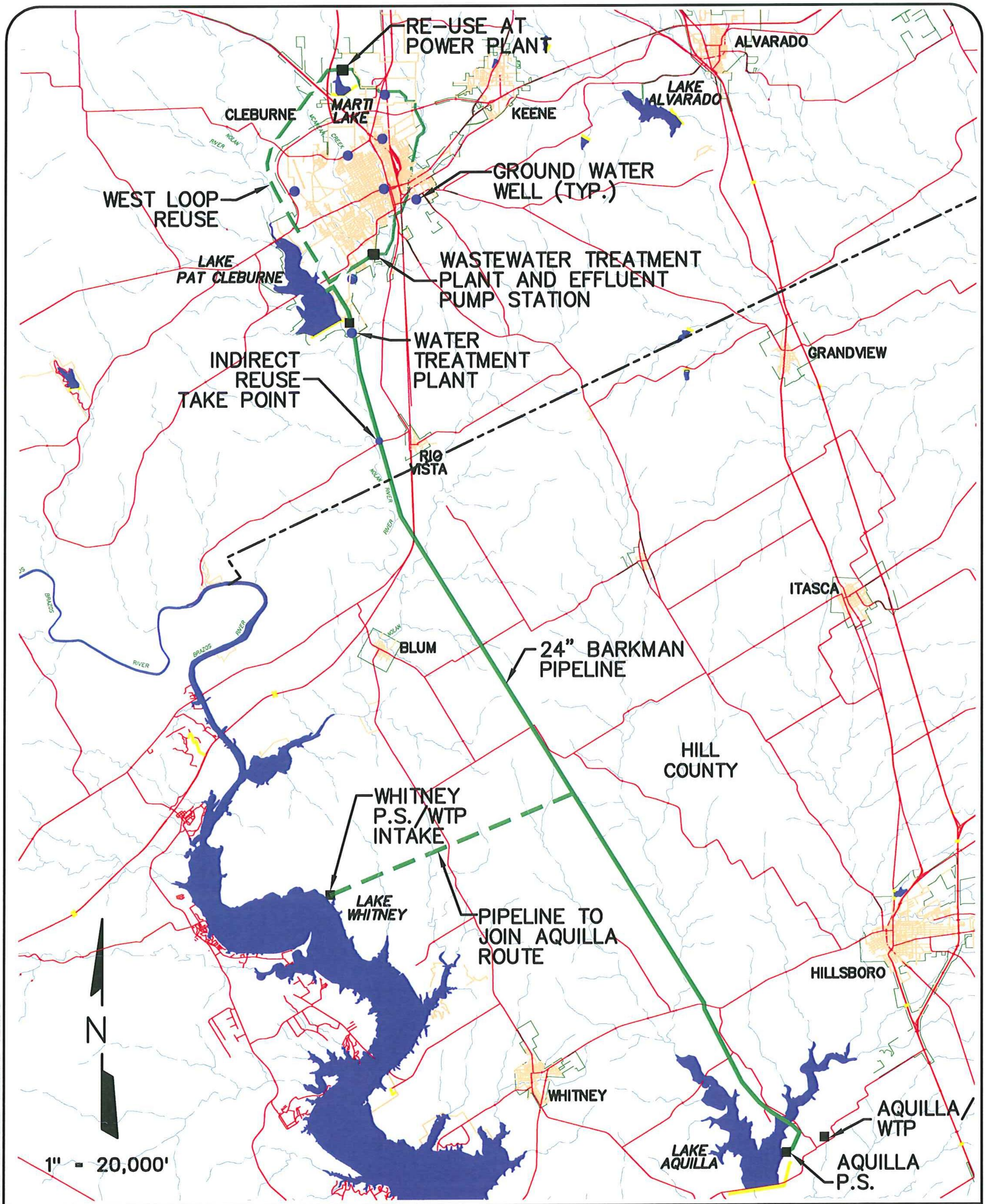
c. Reuse Strategy 2 – New West Loop Reuse Line:
   - Cost Source: City of Cleburne
   - Date to be Implemented: before 2010
   - Total Project Cost: $7,384,900
   - Annual Cost: $853,900

d. Phase I Lake Whitney Water Supply Project:
   - Cost Source: City of Cleburne
   - Date to be Implemented: before 2010, with future phases
   - Total Project Cost : $42,221,700 (Phase I)
   - Annual Cost: $4,690,100 (Phase I)

Table 4C.17-6.
Recommended Plan Costs by Decade for the City of Cleburne

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	4,225	3,013	1,791	483	(1,051)	(2,853)
Conservation						
Supply From Plan Element (acft/yr)	229	515	454	413	416	473
Annual Cost ($/yr)	$87,020	$195,700	$172,520	$156,940	$158,080	$179,740
Unit Cost ($/acft)	$530	$530	$530	$530	$530	$530
Reuse Strategy 1 – Expanded Use of Existing System						
Supply From Plan Element (acft/yr)	351	351	351	351	1,051	2,853
Annual Cost ($/yr)	$186,030	$186,030	$186,030	$186,030	$557,030	$1,512,090
Unit Cost ($/acft)	$530	$530	$530	$530	$530	$530
Reuse Strategy 2 – New West Loop Reuse Line						
Supply From Plan Element (acft/yr)[1]	1,680	1,680	1,680	1,680	1,680	1,680
Annual Cost ($/yr)	$853,900	$853,900	$853,900	$853,900	$853,900	$853,900
Unit Cost ($/acft)	$508	$508	$508	$508	$508	$508
Phase I Lake Whitney Water Supply Project						
Supply From Plan Element (acft/yr)[1]	2,128	2,128	2,128	2,128	2,128	2,128
Annual Cost ($/yr)	$4,69,100	$4,69,100	$4,69,100	$4,69,100	$4,69,100	$4,69,100
Unit Cost ($/acft)	2,554	2,554	2,554	2,554	2,554	2,554

Note 1: 90 % Treatment Recovery Rate with blending



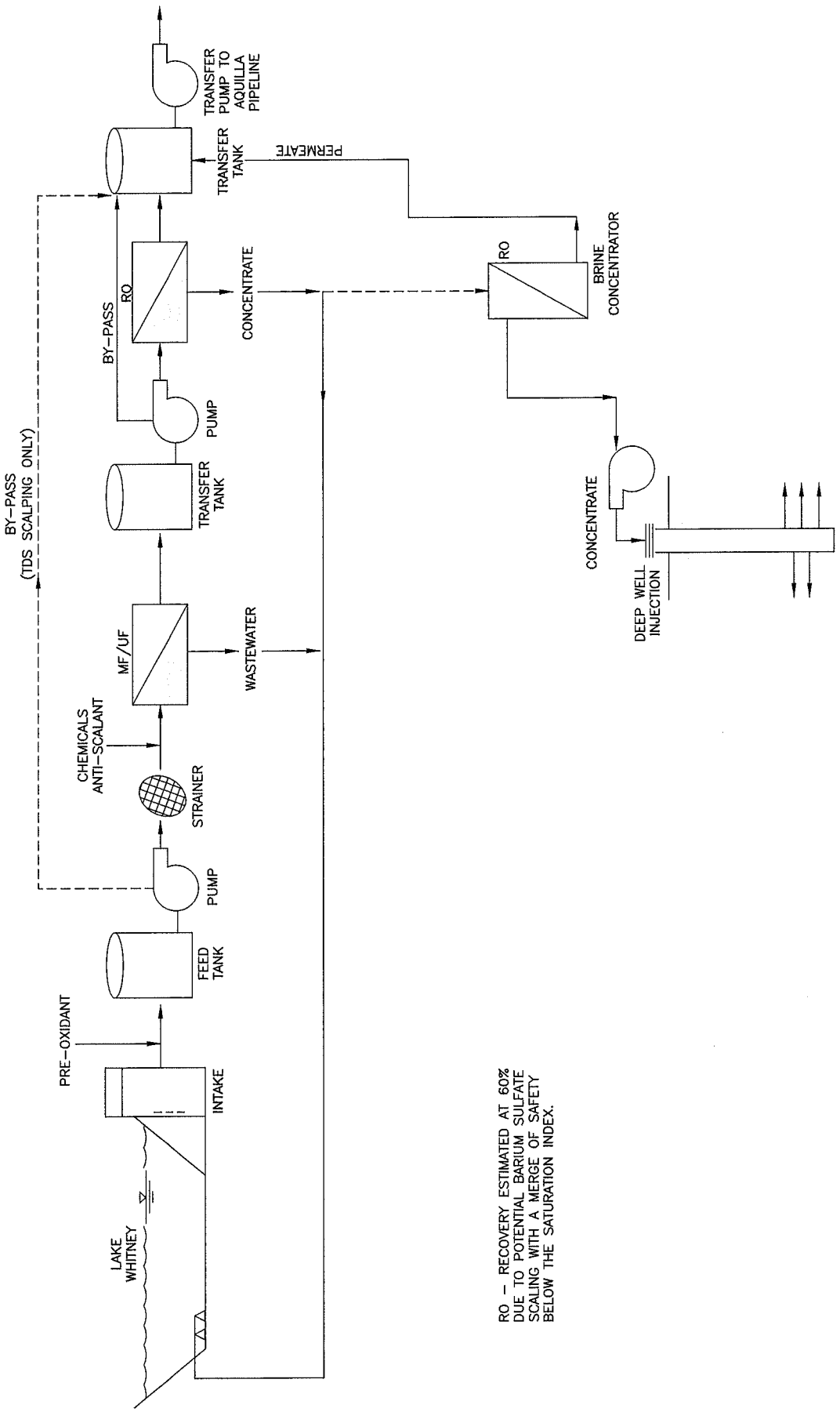
Freese and Nichols

CITY OF CLEBURNE, TEXAS

WATER SUPPLY PROJECT

Figure 1

Date: Apr 24, 2008 - 7:46am User: gdl File: N:\wr\Report\FIGURE 1.dwg



RO - RECOVERY ESTIMATED AT 60% DUE TO POTENTIAL BARIUM SULFATE SCALING WITH A MERGE OF SAFETY BELOW THE SATURATION INDEX.

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CITY OF CLEBURNE, TEXAS

LAKE WHITNEY ADVANCED TREATMENT OPTIONS PROCESS SCHEMATIC

FIGURE 2

ACAD Rel 17.0s (LMS Tech) User: GAL
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Request for Amendment to the Region G Water Plan to Add Development of the Somervell County Water Supply Project

1. Background

The *2006 Brazos G Regional Water Plan* included the Wheeler Branch Off-Channel Reservoir as a water management strategy to address water supply needs in Somervell County. The Somervell County Water District has now constructed the reservoir and the associated raw water supply facilities. To make a potable water supply available for use in Glen Rose and Somervell County, the District now wishes to develop a water treatment plant and a transmission system to deliver water to wholesale and retail customers.

Luminant Power owns and operates the Comanche Peak Steam Electric Generating Station in Somervell County. Luminant would like to purchase water from the Somervell County Water District to provide potable water for the plant and high quality process water.

The Texas Water Development Board has determined that the treatment plant and transmission system needed to implement the Somervell County Water Project are not consistent with the *2006 Brazos G Regional Water Plan*. On March 24, 2008, Kevin Taylor, general manager of the Somervell County Water District, wrote to Scott Mack, Chair of the Brazos G Water Planning Group, requesting an amendment to the *2006 Brazos G Regional Water Plan* to add the development of the Somervell County Water Supply Project.

2. Amendment Request

The Somervell County Water District asks that the *2006 Brazos G Regional Water Plan* be amended to add the Somervell County Water Project, which includes:

- Development of a water treatment plant and high service pump station and later expansion.
- Development of transmission facilities to deliver water to wholesale and retail customers.
- Use of the water to meet municipal, manufacturing, steam electric generation, mining, irrigation, and livestock needs in Somervell County.

The District believes that this amendment meets the Texas Water Development Board criteria for a minor amendment to the *2006 Brazos G Regional Water Plan*, as laid out in Texas Administrative Code Rule 357.16:

- It does not result in over allocation of an existing or planned source of water. The amendment does not change the allocation of any source of supply.
- It does not relate to a new reservoir. The amendment only relates to the development of treatment and transmission facilities.
- It does not have a significant impact on instream flows, environmental flows, or freshwater flows to bays and estuaries.
- It does not have a significant impact on water planning or previously adopted management strategies.
- It does not delete or change any legal requirements of the plan.

If the Brazos G Regional Planning Group or the Texas Water Development Board determines that the requested amendment cannot be processed as a minor amendment, the District requests that it be processed as a major amendment.

3. Description of Strategy

Somervell County currently obtains all of its water supply from the Trinity Aquifer. As indicated in the U.S. Corps of Engineers "Department of the Army Evaluation and Decision Document" for the Section 404 permit obtained for Wheeler Branch Reservoir [Corps of Engineers, 2005]:

> "The Trinity aquifer is heavily used and is currently being over-drafted in Somervell County…. Measurements by the Texas Water Development Board (TWDB) show that water levels of the Glen Rose municipal well No. 2 have declined by over 130 feet since 1974. The current need for municipal water in Somervell County is approximately 1,000 acre-feet per year and is projected to increase to approximately 2,500 acre-feet per year by 2050. According to Senate Bill One evaluations, the current available municipal supply in the county is 773 acre-feet per year. To meet future demands, the county would need to develop approximately 2,000 acre-feet of additional supply by 2050. This amount would enable the District to meet all anticipated needs of Glen Rose through 2050 and about 70 percent of the expected requirements for the remainder of the county."

The development of the proposed treatment and transmission facilities is necessary to allow use of this surface water supply and relieve overuse of groundwater in this growing county.

Figure 1.1 is a map showing Phases 1 though 4 of the proposed Somervell County Water Supply Project. This part of the project is planned for development in the near future (completion shortly after 2010). Figure 1.2 shows the entire proposed project, including Phases 5 through 13, which are planned for future development. Figures 1.1 and 1.2 are at the end of this memorandum.

Phases 1 through 4 include development of a 1.5 mgd water treatment plant below the Wheeler Branch Dam, along with a transmission system to deliver the treated water to wholesale customers and some retail customers. Phases 5 through 13 include expansion of the plant to 5 mgd and development of the remaining transmission facilities needed to serve the entire county.

4. Available Supply

The Somervell County Water District has a water right for 2,000 acre-feet per year from the Wheeler Branch Reservoir. The District has a subordination agreement with the Brazos River Authority that makes the 2,000 acre-feet per year available on a reliable basis. The proposed Somervell County Water Project, which is the subject of this amendment, will make 2,000 acre-feet pear year available as potable water (840 acre-feet per year from Phases 1 through 4 and 1,160 acre-feet per year from Phases 5 through 13).

5. Environmental

Environmental impacts could include:

- Possible minor impacts on riparian corridors, depending on location of pipelines.
- Other possible minor impacts from pipeline development.

The impacts of pipeline development will be minimized to the extent possible by following existing roadway corridors and by avoiding environmentally sensitive areas where feasible. A summary of environmental issues is presented in Table 1.

Table 1
Environmental Issues:
Somervell County Water Supply Project

Water Management Option	Somervell County Water Supply Project
Implementation Measures	Construction of a 5.0 mgd water treatment plant, pump stations, ground and elevated storage tanks, and pipelines (156.2 miles)
Environmental Water Needs/Instream Flows	Negligible impact.
Bays and Estuaries	Negligible impact.
Fish and Wildlife Habitat	Possible minor impacts on riparian corridors, depending on specific location of pipelines.
Cultural Resources	Possible low impact.
Threatened and Endangered Species	Possible low impact.

6. Engineering and Costing

Figures 1 and 2 show the facilities required to develop the Somervell County Water Project. Water from Wheeler Branch Reservoir will be treated at the water treatment plant below the dam and distributed to the county by a system of pump stations, ground and elevated storage tanks, and pipelines. Phases 1 through 4 will include a 1.5 mgd water treatment plant and high service pump station, 1 booster pump station, 2 ground storage tanks, 1 elevated tank, and 30.5 miles of pipeline ranging from 6 inches to 18 inches in diameter. Phases 5 through 13 will include expanding the water treatment plant and high service pump station to 5.0 mgd, 5 booster pump stations, 4 ground storage tanks, 4 elevated tanks, and 125.7 miles of pipeline ranging from 6 inches to 12 inches in diameter.

Table 2 summarizes the capital costs for Phases 1 through 4, which total $17,099,200 using the 2002 costs assumed in the *2006 Brazos G Regional Water Plan.*

Table 2
Cost Estimate Summary for
Somervell County Water Supply Project Phases 1 through 4
(Second Quarter 2002 Prices and 2008 Prices)

Item	Estimated Cost for Retail Facilities (2002 $)	Estimated Cost for Wholesale Facilities (2002 $)	Estimated Cost for Facilities (2002 $)	Estimated Cost for Facilities (2008 $)
Capital Costs				
6" WL and Appurtenances	$ 315,100	$ -	$ 315,100	$ 376,200
8" WL and Appurtenances	$ 663,300	$ 187,900	$ 851,200	$ 1,016,400
10" WL and Appurtenances	$ -	$ 488,300	$ 488,300	$ 583,000
12" WL and Appurtenances	$ 447,700	$ 3,697,900	$ 4,145,600	$ 4,950,000
16" WL and Appurtenances	$ -	$ 2,726,900	$ 2,726,900	$ 3,256,000
18" WL and Appurtenances	$ -	$ 323,400	$ 323,400	$ 386,100
Boring and Casing	$ 167,500	$ 376,900	$ 544,400	$ 650,000
Installation through Rock	$ 70,400	$ 511,000	$ 581,400	$ 694,200
Pavement Repair	$ 32,200	$ 202,300	$ 234,500	$ 280,000
New 1.5 MGD Water Treatment Plant	$ -	$ 4,187,500	$ 4,187,500	$ 5,000,000
1.5 MGD HSPS	$ -	$ 418,800	$ 418,800	$ 500,000
Ground Storage Tanks	$ -	$ 837,500	$ 837,500	$ 1,000,000
Elevated Storage Tanks	$ -	$ 1,046,900	$ 1,046,900	$ 1,250,000
Booster Pump Station	$ -	$ 397,800	$ 397,800	$ 475,000
Total Capital Costs	**$ 1,696,200**	**$ 15,403,000**	**$ 17,099,200**	**$ 20,416,900**
Contingencies	$ 339,200	$ 3,080,600	$ 3,419,800	$ 4,083,380
Engineering, Permitting, Survey, and Geotech	$ 305,300	$ 2,772,500	$ 3,077,800	$ 3,675,042
Land Costs	$ 47,100	$ 262,800	$ 309,900	$ 370,000
Power Supply Costs	$ -	$ 128,100	$ 128,100	$ 152,919
Interest During Construction (1 year)	$ 101,800	$ 924,200	$ 1,025,900	$ 1,225,014
Total Project Costs	**$ 2,489,600**	**$ 22,571,200**	**$ 25,060,800**	**$ 29,923,300**
Annual Costs				
Debt Service (6 percent for 30 years)	$ 181,000	$ 1,641,000	$ 1,822,000	$ 2,175,000
Operation and Maintenance	$ 37,700	$ 338,400	$ 376,000	$ 449,000
Energy Costs (319,800 kWh @ $0.06/kWh)	$ 1,903	$ 17,285	$ 19,188	$ 25,584
Total Annual Costs	**$ 220,600**	**$ 1,996,700**	**$ 2,217,200**	**$ 2,649,600**
Available Project Yield (ac-ft/yr)		**840**	**840**	**840**
Annual Cost of Water ($ per ac-ft)		**$ 2,377**	**$ 2,640**	**$ 3,154**
Annual Cost of Water ($ per 1,000 gallons)		**$ 7.30**	**$ 8.10**	**$ 9.68**

Notes:
1. 2008 Costs were reduced to 2002 Costs using 3% Inflation per year over 6 years.
2. 2008 Power Costs are based on $0.08/kWh. 2002 power costs are $0.06/kWh.

Professional services, land costs, power supply costs, contingencies, and interest during construction will add $7,961,500, for a total project cost of $25,060,800. (At 2008 prices, the estimated cost is $29,923,300.) With 6 percent interest and 30-year bonds, the annual debt service is $1,822,000. Operation and maintenance costs for pumping, transmission, and treatment add $395,200 per year, for a total annual cost of $2,217,200 (at 2002 prices) for delivery of 840 acre-feet. The cost of treated water delivered is $2,640 per acre-foot, or $8.10 per thousand gallons. This relatively high cost is associated with the development of a new surface water supply system for a relatively small volume of water. The cost of treated water delivered considering only wholesale facilities is $2,377 per acre-foot, or $7.30 per thousand gallons.

Table 3 summarizes the capital costs for Phases 5 through 13, which total $42,263,100 using the 2002 costs assumed in the *2006 Brazos G Regional Water Plan.* Professional services, land costs, power supply costs, contingencies, and interest during construction will add $19,902,900, for a total project cost of $62,166,000. (At 2008 prices, the estimated cost is $74,228,100.) With 6 percent interest and 30-year bonds, the annual debt service is $4,519,000. Operation and maintenance costs for pumping, transmission and treatment add $923,500 per year, for a total annual cost of $5,442,500 (at 2002 prices) for delivery of 1,160 acre-feet. The cost of treated water delivered is $4,692 per acre-foot, or $14.40 per thousand gallons. This cost is associated with the development of a retail distribution system in a rural environment, where a lot of pipeline is needed per customer. Most of the costs of Phases 5 through 13 are associated with the retail distribution system, since Glen Rose and the Comanche Peak Steam Electric Station are the only significant wholesale customers in the county. The wholesale costs are $960 per acre-foot, or $2.95 per thousand gallons. Of course, it is possible that other wholesale customers will develop before the system is actually built.

Table 3
Cost Estimate Summary for
Somervell County Water Supply Project Phases 5 through 13
(Second Quarter 2002 Prices and 2008 Prices)

Item	Estimated Cost for Retail Facilities (2002 $)	Estimated Cost for Wholesale Facilities (2002 $)	Estimated Cost for Facilities (2002 $)	Estimated Cost for Facilities (2008 $)
Capital Costs	$ 2,846,700	$ -	$ 2,846,700	$ 3,399,000
6" WL and Appurtenances	$ 14,572,300	$ 845,700	$ 15,418,000	$ 18,409,600
8" WL and Appurtenances	$ 2,197,200	$ -	$ 2,197,200	$ 2,623,500
10" WL and Appurtenances	$ 4,666,900	$ 176,900	$ 4,843,800	$ 5,783,600
12" WL and Appurtenances	$ 1,423,800	$ 50,300	$ 1,474,000	$ 1,760,000
Boring and Casing	$ 1,554,600	$ -	$ 1,554,600	$ 1,856,200
Installation through Rock	$ 853,000	$ 82,100	$ 935,100	$ 1,116,500
Pavement Repair	$ -	$ 5,862,500	$ 5,862,500	$ 7,000,000
Water Treatment Plant Expansion to 5 MGD	$ -	$ 963,100	$ 963,100	$ 1,150,000
HSPS Expansion to 5 MGD	$ 213,600	$ -	$ 213,600	$ 255,000
Flow Control Valves	$ 1,549,400	$ -	$ 1,549,400	$ 1,850,000
Ground Storage Tanks	$ 3,643,100	$ -	$ 3,643,100	$ 4,350,000
Elevated Storage Tanks	$ 762,100	$ -	$ 762,100	$ 910,000
Booster Pump Station	**$ 34,282,600**	**$ 7,980,500**	**$ 42,263,100**	**$ 50,463,400**
Total Capital Costs				
	$ 6,856,500	$ 1,596,100	$ 8,452,600	$ 10,092,680
Contingencies	$ 6,170,900	$ 1,436,500	$ 7,607,400	$ 9,083,412
Engineering, Permitting, Survey, and Geotech	$ 210,400	$ 920,200	$ 1,130,600	$ 1,350,000
Land Costs	$ -	$ 176,600	$ 176,600	$ 210,850
Power Supply Costs	$ 2,057,000	$ 478,800	$ 2,535,800	$ 3,027,804
Interest During Construction (1 year)	**$ 49,577,400**	**$ 12,588,700**	**$ 62,166,000**	**$ 74,228,100**
Total Project Costs				
Annual Costs				
Debt Service (6 percent for 30 years)	$ 3,604,000	$ 915,000	$ 4,519,000	$ 5,396,000
Operation and Maintenance	$ 743,700	$ 188,400	$ 872,300	$ 1,113,000
Energy Costs (852,700 kWh @ $0.06/kWh)	$ 41,501	$ 9,661	$ 51,162	$ 68,216
Total Annual Costs	**$ 4,389,200**	**$ 1,113,100**	**$ 5,442,500**	**$ 6,577,200**
Available Project Yield (ac-ft/yr)		**1160**	**1160**	**1160**
Annual Cost of Water ($ per ac-ft)		**$ 960**	**$ 4,692**	**$ 5,670**
Annual Cost of Water ($ per 1,000 gallons)		**$ 2.95**	**$ 14.40**	**$ 17.40**

Notes:

1. 2008 Costs were reduced to 2002 Costs using 3% Inflation per year over 6 years.
2. 2008 Power Costs are based on $0.08/kWh. 2002 costs are based on $0.06/kWh.

7. Implementation Issues

The Somervell County Water District will need to reach agreements with the City of Glen Rose and Comanche Peak Steam Electric Station as wholesale customers to implement this water management strategy. Other implementation issues will include financing and Section 404 permitting. As shown in Table 4, this water management strategy has been compared to the plan development criteria.

8. Potential Regulatory Requirements

Implementation of this water management strategy will require the following permits for pipeline construction:

- U.S. Army Corps of Engineers Section 404 permit for pipeline stream crossings and discharges of fill into wetlands and waters of the U.S. during construction.
- NPDES Stormwater Pollution Prevention Plans.
- Possibly TP&WD Sand, Shell, Gravel, and Marl permits for construction in state-owned stream beds.

Table 4
Comparison of Somervell County Water Supply Project
to Plan Development Criteria

Impact category	*Comment(s)*
A. Water Supply	
1. Quantity	1. Sufficient for local needs.
2. Reliability	2. High.
3. Cost	3. Relatively high, but reasonable for a county-wide system.
B. Environmental Factors	
1. Environmental Water Needs	1. Low impact.
2. Habitat	2. Low impact.
3. Cultural Resources	3. Low impact.
4. Bays and Estuaries	4. Low impact.
5. Threatened and Endangered Species	5. Low impact.
6. Wetlands	6. Low impact.
C. Impact on Other State Water Resources	No apparent negative impacts on state water resources. No effect on navigation.
D. Threats to Agriculture and Natural Resources	None.
E. Equitable Comparison of Strategies Deemed Feasible	Done.
F. Requirements for Interbasin Transfers	Not applicable.
G. Third Party Social and Economic Impacts from Voluntary Redistribution	None.

4C.30 Somervell County Water Supply Plan

Table 4C.30-1 lists each water user group in Somervell County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.30-1.
Somervell County Surplus/(Shortage)

Water User Group	*Surplus/(Shortage)*[1]		*Comment*
	2030 (acft/yr)	*2060 (acft/yr)*	
City of Glen Rose	38	37	Projected surplus
County-Other	(231)	(260)	Projected shortage – see plan below
Manufacturing	(4)	(7)	Projected shortage – see plan below
Steam-Electric	25,570	25,510	Projected surplus
Mining	(94)	(85)	Projected shortage – see plan below
Irrigation	945	953	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables C-59 and C-60, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.30.1 The City of Glen Rose

4C.30.1.1 Description of Supply

The City of Glen Rose obtains groundwater from the Trinity Aquifer. No shortage is projected for the City of Glen Rose. However, Glen Rose may obtain supplemental surface water supplies from the Somervell County Water Supply Project.

4C.30.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to supplement existing supplies for the City of Glen Rose:

- Somervell County Water Supply Project – the project will treat raw water from Wheeler Branch Off-Channel Reservoir and transmit the treated water to customers of the Somervell County Water District.

4C.30.1.3 Costs

Costs of the Somervell County Water Supply Project are discussed in Section 4C.30.2.3 below.

Table 4C.30-1.
Recommended Plan Costs by Decade for the City of Glen Rose

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	57	46	38	36	36	37
Somervell County Water Supply Project (Phases 1 – 4)*						
Supply From Plan Element (acft/yr)	340	340	340	340	340	340
Annual Cost ($/yr)	$808,188	$808,188	$808,188	$143,974	$143,974	$143,974
Unit Cost ($/acft)	$2,377	$2,377	$2,377	$423	$423	$423
Somervell County Water Supply Project (Phases 5 – 13)*						
Supply From Plan Element (acft/yr)	–	–	260	260	260	260
Annual Cost ($/yr)	–	–	$249,488	$249,488	$249,488	$44,402
Unit Cost ($/acft)	–	–	$960	$960	$960	$171

* Note: This supply is from the Wheeler Branch Reservoir, which has been implemented. The project is for development of treatment and transmission facilities.

4C.30.2 County-Other

4C.30.2.1 Description of Supply

Somervell County-Other obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Somervell County-Other is projected to have a shortage of 231 acft/yr in the year 2030 and 260 acft/yr in the year 2060.

4C.30.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Somervell County-Other:

- Wheeler Branch Off-Channel Reservoir – the project has obtained a water rights permit from the TCEQ and is projected to be completed by 2010
- Somervell County Water Supply Project – the project will treat raw water from Wheeler Branch Off-Channel Reservoir and transmit the treated water to customers of the Somervell County Water District.

- Conservation was also considered; however, the County-Other's per capita use rate is below the selected target rate of 140 gpcd.

4C.30.2.3 Costs

Costs of the Recommended Plan for Somervell County-Other.

a. Wheeler Branch Off-Channel Reservoir:
   - Cost Source: Volume II, Section 4B.13.3
   - Date to be Implemented: before 2010
   - Total Project Cost: $27,195,000
   - Annual Cost: $2,117,000

b. Somervell County Water Supply Project:
   - Cost Source: Somervell County Water District
   - Date to be Implemented: before 2010, with future phases
   - Total Project Cost: $87,226,800 (Phases 1 – 13). (Excluding retail distribution, the cost is $35,159,900.(
   - Annual Cost: $7,659,700 (Phases 1 – 13). (Excluding retail distribution, the annual cost is $3,109,800.)

Table 4C.30-2.
Recommended Plan Costs by Decade for Somervell County-Other

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(133)	(189)	(231)	(251)	(257)	(260)
Wheeler Branch Off-Channel Reservoir						
Supply From Plan Element (acft/yr)	1,800	1,800	1,800	1,800	1,800	1,800
Annual Cost ($/yr)	$2,117,000	$2,117,000	$2,117,000	$2,117,000	$2,117,000	$2,117,000
Unit Cost ($/acft)	$1,176	$1,176	$1,176	$1,176	$1,176	$1,176
Somervell County Water Supply Project (Phases 1 – 4)*						
Supply From Plan Element (acft/yr)	200	200	200	200	200	200
Annual Cost ($/yr)	$475,405	$475,405	$475,405	$84,690	$84,690	$84,690
Unit Cost ($/acft)	$2,377	$2,377	$2,377	$423	$423	$423
Somervell County Water Supply Project (Phases 5 – 13)*						
Supply From Plan Element (acft/yr)	–	–	516	516	516	516
Annual Cost ($/yr)	–	–	$495,138	$495,138	$495,138	$88,120
Unit Cost ($/acft)	–	–	$960	$960	$960	$171

* Note: This supply is from the Wheeler Branch Reservoir, which has been implemented. The project is for development of treatment and transmission facilities.

4C.30.3 Manufacturing

4C.30.3.1 Description of Supply

Somervell County Manufacturing obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Somervell County Manufacturing is projected to have a shortage of 4 acft/yr in the year 2030 and 7 acft/yr in the year 2060.

4C.30.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Somervell County Manufacturing:

- Conservation, and
- Purchase water from the City of Glen Rose.

4C.30.3.3 Costs

Costs of the Recommended Plan for Somervell County Manufacturing.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Water Supply from City of Glen Rose:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2010
   - Annual Cost: $16,161 in 2060

   The annual cost was calculated by multiplying the Manufacturing projected supply from this strategy by an estimated wholesale water rate of $162/acft.

Table 4C.30-3.
Recommended Plan Costs by Decade for Somervell County Manufacturing

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(2)	(3)	(4)	(5)	(6)	(7)
Conservation						
Supply From Plan Element (acft/yr)	0	0	1	1	1	1
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Water Supply from City of Glen Rose						
Supply From Plan Element (acft/yr)	10	10	10	10	10	10
Annual Cost ($/yr)	$16,161	$16,161	$16,161	$16,161	$16,161	$16,161
Unit Cost ($/acft)	$162	$162	$162	$162	$162	$162

4C.30.4 Steam-Electric

4C.30.4.1 Description of Supply

Somervell County Steam-Electric is projected to have a surplus of water through 2060. Potable water for plant staff and high-quality process water for boiler feed at the Comanche Peak Steam Electric Station is currently provided from local groundwater. When the Somervell County Water Supply Project is developed, some potable water and process water for the plant will be obtained from the project.

4C.30.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to supplement existing supplies for Somervell County Steam-Electric:

- Somervell County Water Supply Project – the project will treat raw water from Wheeler Branch Off-Channel Reservoir and transmit the treated water to customers of the Somervell County Water District.
- Conservation was also considered; however, the Somervell County Steam-Electric is already exercising substantial conservation.

4C.30.4.3 Costs

Costs of the Somervell County Water Supply Project are discussed in Section 4C.30.2.3 above.

Table 4C.30-4.
Recommended Plan Costs by Decade for Somervell County Steam-Electric

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)						
Somervell County Water Supply Project (Phases 1 – 4)*						
Supply From Plan Element (acft/yr)	300	300	300	300	300	300
Annual Cost ($/yr)	$713,107	$713,107	$713,107	$127,036	$127,036	$127,036
Unit Cost ($/acft)	$2,377	$2,377	$2,377	$423	$423	$423
Somervell County Water Supply Project (Phases 5 – 13)*						
Supply From Plan Element (acft/yr)	–	–	184	184	184	184
Annual Cost ($/yr)	–	–	$176,561	$176,561	$176,561	$31,423
Unit Cost ($/acft)	–	–	$960	$960	$960	$171

* Note: This supply is from the Wheeler Branch Reservoir, which has been implemented. The project is for development of treatment and transmission facilities.

4C.30.5 Mining

4C.30.5.1 Description of Supply

Somervell County Mining obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Somervell County Mining is projected to have a shortage of 94 acft/yr in the year 2030 and 85 acft/yr in the year 2060.

4C.30.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Somervell County Mining:

- Conservation, and
- Voluntary Redistribution from Steam-Electric.

4C.30.5.3 Costs

Costs of the Recommended Plan for Somervell County Mining.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Voluntary Redistribution from Steam-Electric:
   - Cost Source: assumed unit cost for raw water transfer between entities
   - Date to be Implemented: before 2010
   - Unit Cost: $75/acft
   - Annual Cost: $11,250

Table 4C.30-4.
Recommended Plan Costs by Decade for Somervell County Mining

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(106)	(98)	(94)	(91)	(88)	(85)
Conservation						
Supply From Plan Element (acft/yr)	9	14	19	19	18	18
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Voluntary Redistribution from Steam-Electric						
Supply From Plan Element (acft/yr)	150	150	150	150	150	150
Annual Cost ($/yr)	$11,250	$11,250	$11,250	$11,250	$11,250	$11,250
Unit Cost ($/acft)	$75	$75	$75	$75	$75	$75

4C.30.6 Irrigation

Somervell County Irrigation is projected to have a surplus of water through 2060 and no changes in water supply are recommended.

4C.30.7 Livestock

No shortages are projected for Somervell County Livestock and no changes in water supply are recommended.

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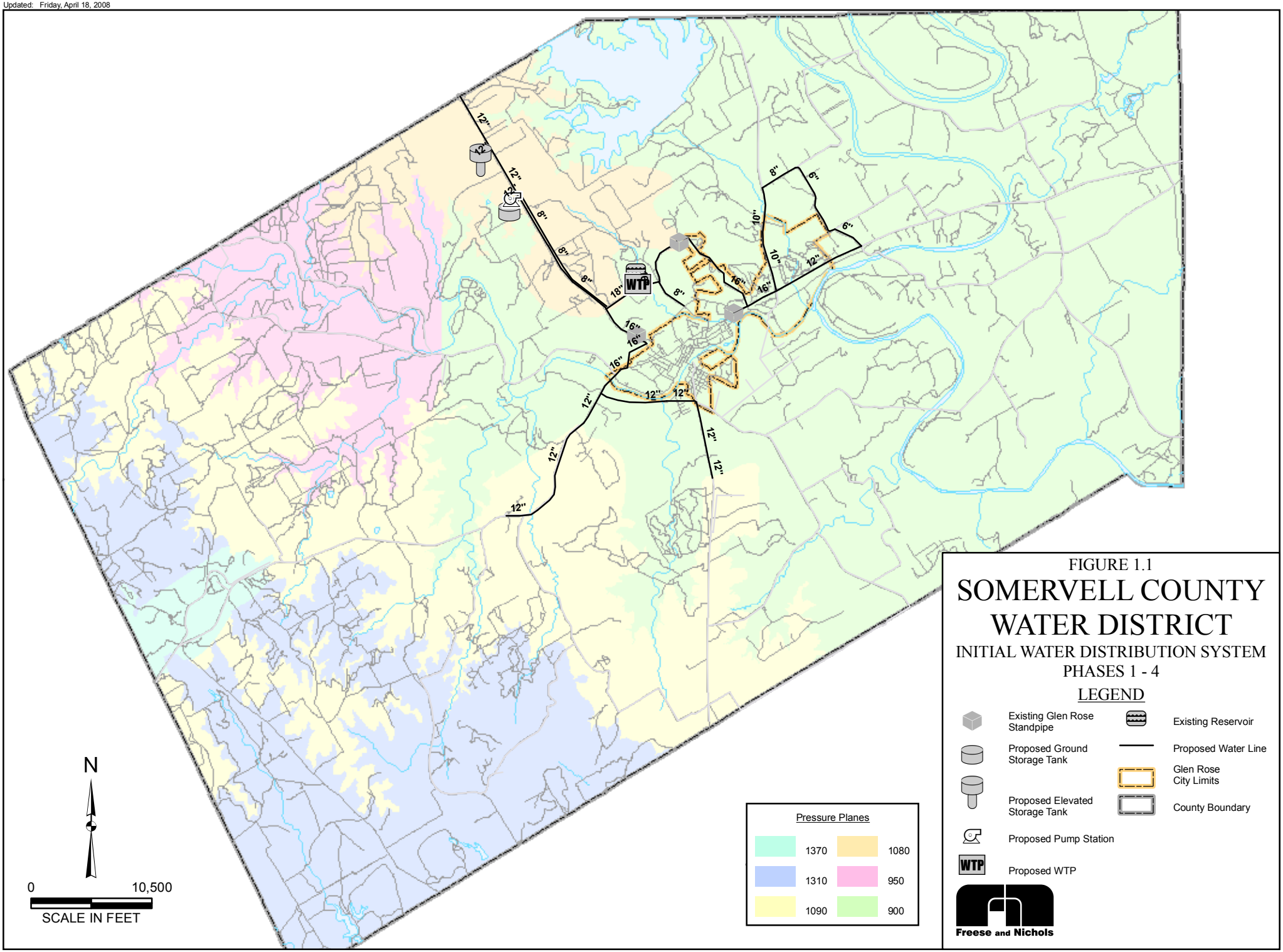

FIGURE 1.1

SOMERVELL COUNTY WATER DISTRICT

INITIAL WATER DISTRIBUTION SYSTEM PHASES 1 - 4

LEGEND

- Existing Glen Rose Standpipe
- Existing Reservoir
- Proposed Ground Storage Tank
- Proposed Water Line
- Glen Rose City Limits
- Proposed Elevated Storage Tank
- County Boundary
- Proposed Pump Station
- Proposed WTP

Freese and Nichols

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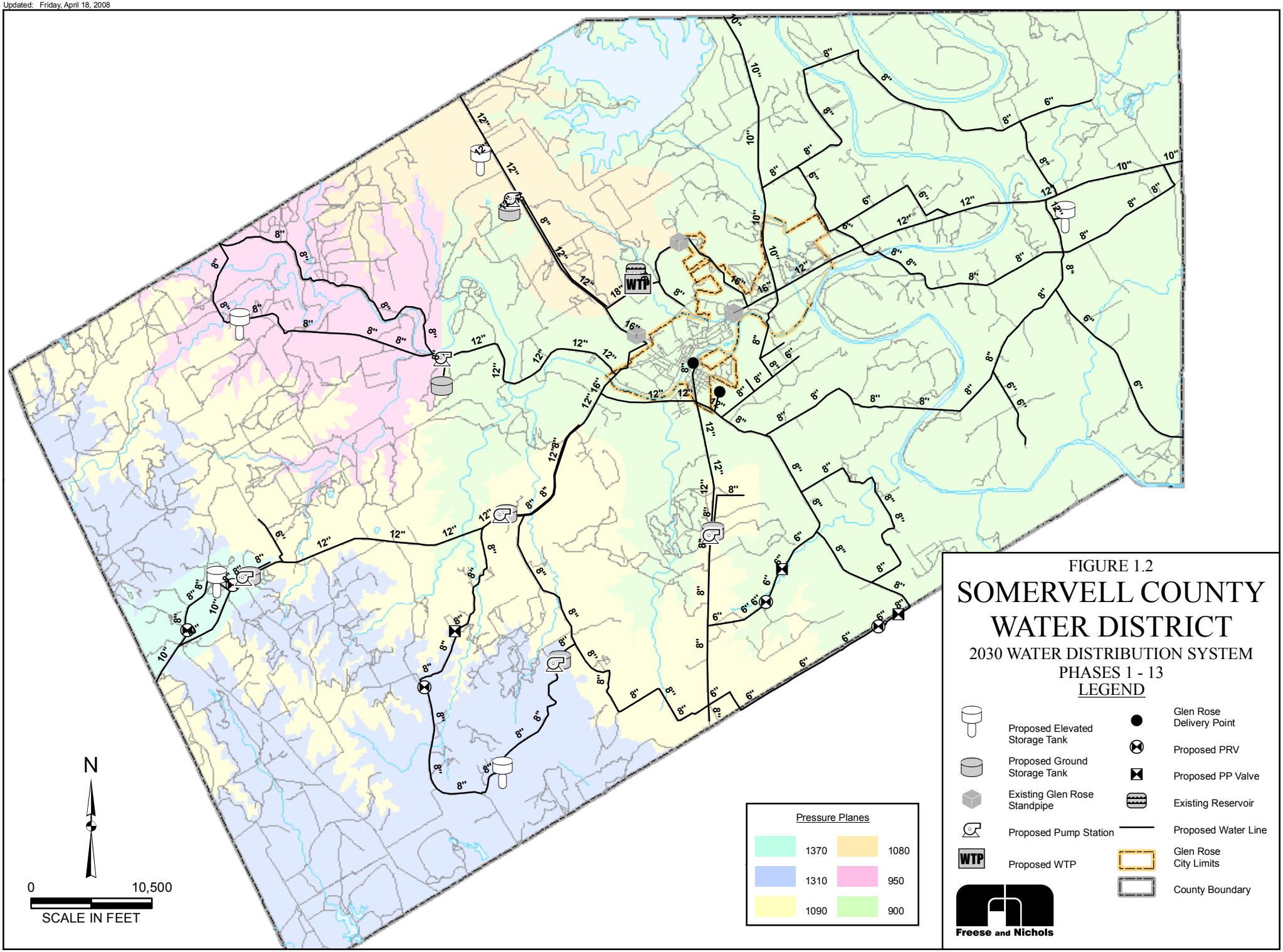

FIGURE 1.2

SOMERVELL COUNTY WATER DISTRICT

2030 WATER DISTRIBUTION SYSTEM PHASES 1 - 13

LEGEND

- Proposed Elevated Storage Tank
- Proposed Ground Storage Tank
- Existing Glen Rose Standpipe
- Proposed Pump Station
- Proposed WTP
- Glen Rose Delivery Point
- Proposed PRV
- Proposed PP Valve
- Existing Reservoir
- Proposed Water Line
- Glen Rose City Limits
- County Boundary

Freese and Nichols

Somervell County Steam Electric Supply from the Brazos River Authority

1.0 Description of Option

Luminant Power (formerly Texas Utilities or TXU) operates the Comanche Peak Station, which consists of two nuclear generating units located in Somervell County near Glen Rose, Texas. Water used to cool the two existing units is diverted from Squaw Creek Reservoir, supplemented with diversions from Lake Granbury, which is owned and operated by the Brazos River Authority (BRA). Water is diverted from Lake Granbury into Squaw Creek Reservoir, and circulated through the generating units prior to being discharged back into Squaw Creek Reservoir, and subsequently to the Brazos River via Squaw Creek.

Luminant is planning to build two additional 1,700 MW nuclear generating units at the Comanche Peak site, and intends to cool those units with additional water obtained from the BRA, diverted near the existing location on the southwest shore of Lake Granbury. Water would be pumped through two new pipelines into cooling towers at the new generating units. Blowdown from the cooling towers would be discharged back into Lake Granbury at a location downstream from the intake location. The two new units would operate independent and separate from the two existing units, and will not involve Squaw Creek Reservoir. The addition of the two generating units to Luminant's plans creates an additional Steam-Electric water demand in Somervell County that was not considered in the 2006 Brazos G Regional Water Plan.

Water would be delivered to the units separately through two, new 42-inch diameter pipelines. Similarly, blowdown water from the cooling towers would be returned through two, new 36-inch diameter pipelines. All new pipelines will be placed into or adjacent to the right-of-way for the existing pipelines between Lake Granbury and Squaw Creek Reservoir. The new pipelines would then be routed around the southern extent of Squaw Creek Reservoir to the new generating units on property currently owned by Luminant. The pipelines would be approximately 12 miles long. The approximate routes are shown in Figure 1. The route of the pipeline for discharge of blowdown flows might vary depending on the ultimate discharge location selected.

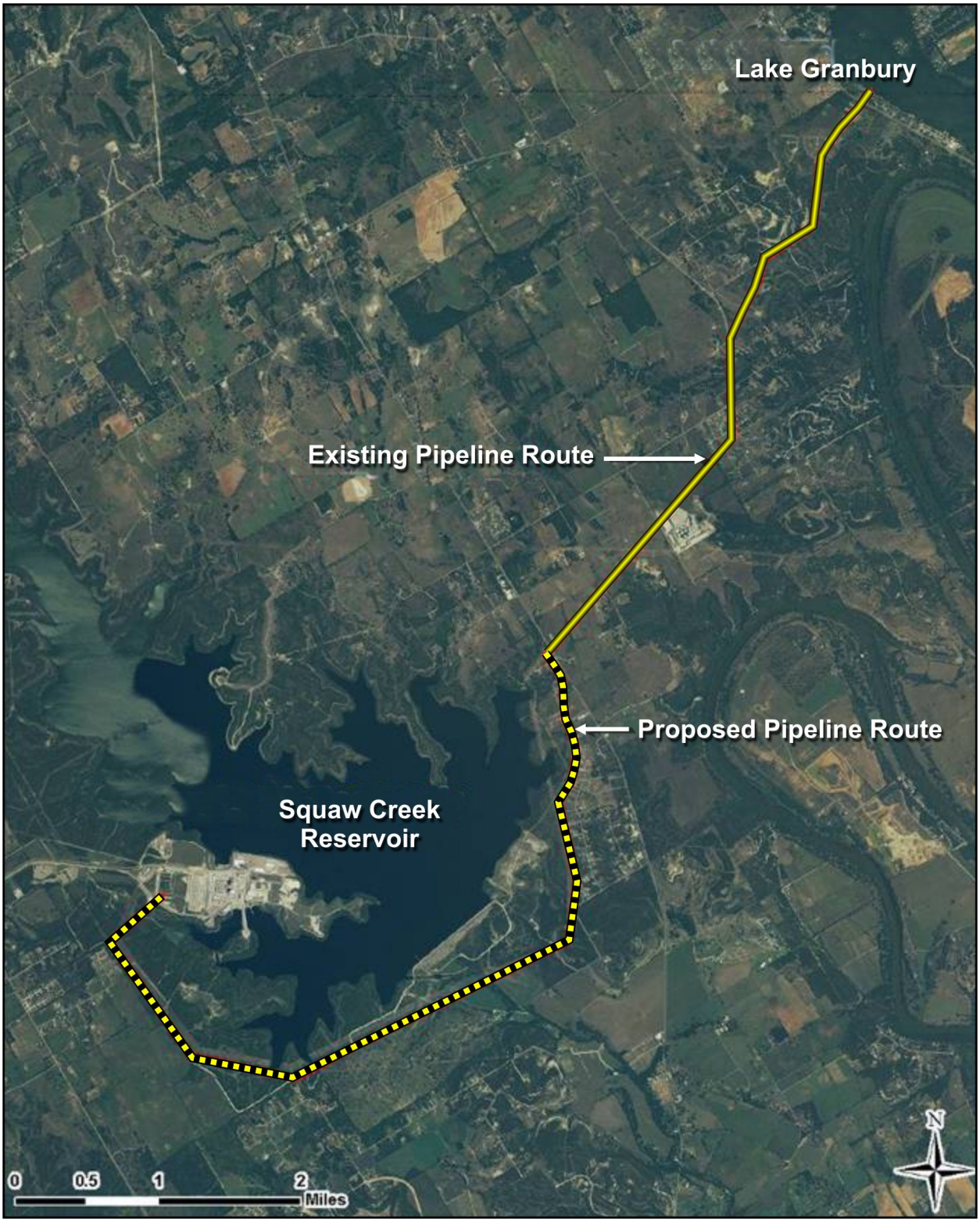

Figure 1. Luminant Pipeline Route.

1.1 Available Yield

Luminant's preliminary engineering has determined that annual diversions totaling 103,717 acre-feet per year (acft/yr) will be needed from Lake Granbury. Luminant currently holds contracts for water supply from the BRA totaling 27,447 acft/yr that have not yet been assigned to any current Luminant facility. Luminant would utilize this existing contractual supply plus an additional 76,270 acft/yr of new contractual water from the BRA. The BRA and Luminant have identified the pending BRA System Operations Permit as the source of supply for this new contractual water.

Analysis regarding the availability of this water supply from the BRA System was determined using the Brazos G WAM. The model utilized a January 1940 through December 1997 hydrologic period of record. Estimates of water availability were derived subject to general assumptions for application of hydrologic models as adopted by the Brazos G Regional Water Planning Group and summarized in the 2006 Brazos G Regional Water Plan. The following modifications to the Brazos G WAM were made to evaluate the supply available to the proposed new diversion from Lake Granbury and to estimate its impacts downstream:

(1) The methodology for modeling the existing Luminant diversion from Lake Granbury to Squaw Creek Reservoir was modified to more accurately depict actual operations. Previously, only the consumptive use was modeled as a diversion from Lake Granbury. This was modified to include diversions from Lake Granbury being discharged into Squaw Creek Reservoir, with actual consumptive use occurring from Squaw Creek Reservoir. Any unused diversions from Lake Granbury are allowed to spill from Squaw Creek Reservoir and contribute to flows downstream on the Brazos River via Squaw Creek.

(2) The diversion location for the unassigned contractual supply (27,447 acft/yr) from the BRA was moved from Possum Kingdom Reservoir to Lake Granbury.

(3) Additional supply to Luminant (76,270 acft/yr) from the pending BRA System Operations Permit was placed at Lake Granbury.

(4) Return flows representing the discharge of cooling tower blowdown into Lake Granbury were added. These are estimated by Luminant to be 42,100 acft/yr.

(5) Four water supply diversions totaling 31,106 acft/yr were included, which would utilize supply from the pending BRA System Operations Permit. These diversions

are included as water management strategies to meet future needs in the 2006 Brazos G Regional Water Plan. Previous analyses of potential supplies available from the BRA System Operations Permit included 10 potential new diversions totaling 65,482 acft/yr in Brazos G. Not all of these 10 diversions were ultimately recommended as water management strategies in the 2006 Plan. Only those four diversions recommended as water management strategies in the 2006 Plan were included in this analysis.

During development of the 2006 Brazos G and Region H Regional Water Plans, the supply from the BRA System to Brazos G and Region H was apportioned as shown in Table 1. The supplies shown in Table 1 are in addition to those supplies for which the BRA had already committed contractually at the time the 2006 plans were developed and may not necessarily reflect current BRA contractual commitments.

Table 1.
Assignment of Uncontracted BRA Supplies Between Brazos G and Region H.

	Region G	***Region H***	***Total***
Uncontracted BRA Supply from Existing Sources	31,955	29,000	60,955
Allens Creek Reservoir Supply	0	99,650	99,650
BRA System Operations Supply	63,510	120,000	183,510
Total Additional Supply from BRA	95,465	248,650	344,115
Note: All values are in acre-feet per year.			

This assignment was negotiated between Brazos G and Region H, and is considered a conservative estimate of supplies that might be available from the BRA System. Actual supplies available to Brazos G and Region H from the BRA System are likely greater, and will depend upon diversion rights granted in the pending BRA System Operations Permit and the diversion locations of future BRA contractual commitments.

For purposes of determining whether sufficient supply is available from the BRA System to meet the additional Luminant diversion from Lake Granbury and what effect, if any, this would have on supplies available to Region H, the model was operated to meet the Brazos G

supply requirements first, with any remaining supply available from the BRA System assigned to a lower basin diversion to represent supplies available to Region H.

Table 2 summarizes these analyses, and compares these analyses to the original Brazos G WAM analysis of the BRA System Operations Permit completed during the development of the 2006 Brazos G Regional Water Plan, and to the supplies assigned to Brazos G and Region H for the 2006 plans.

Table 2.
Summary of Supplies Available to Brazos G and Region H.

Diversions/Returns	*Original Brazos G WAM Analysis*	*Brazos G/Region H Assignment*	*Somervell County Strategy Evaluation*
Brazos G WUG Strategies	65,482	95,465	31,106
New Luminant Diversion	–	–	76,270
Luminant Return	–	–	(42,100)
Total Brazos G Supply	65,482	95,465	65,276
Lower Basin Supply (Region H)	264,000	248,650	258,750

As shown in Table 2, the total supply available to Brazos G from the BRA System when the Luminant strategy is 65,276 acft/yr. This is approximately equal to the supply delineated in the original Brazos G analysis of supplies that might be used to meet ten individual WUG needs. However, the placement of the recommended four WUG diversions in conjunction with the Luminant strategy reduces the efficiency of the BRA System and reduces lower basin (Region H) supplies from 264,000 acft/yr to 258,750 acft/yr. This is still a greater supply than originally apportioned to Region H during development of the 2006 plans.

In summary, there is sufficient supply available from the BRA System to meet the Steam-Electric demands of the proposed Luminant strategy. Based upon actual recommended water management strategies in the 2006 Brazos G Regional Water Plan, the proposed supply to Luminant will not reduce supplies to Region H below what was originally assumed available during development of the 2006 Region H Water Plan.

As the 2006 Brazos G Regional Water Plan already considers this supply from Lake Granbury, there is little to no change in projected Lake Granbury storage or storage in other

reservoirs constituting the BRA System. Figures 2 through 5 illustrate changes in monthly flows resulting from this strategy being implemented in the 2006 Brazos G Regional Water Plan. In the figures, the "Implemented Plan" conditions are projected flows at the subject locations assuming implementation of the 2006 Brazos G Plan. The "Implemented Plan w/Luminant" conditions are projected flows assuming implementation of the 2006 Brazos G Plan with the addition of the Luminant diversion from Lake Granbury.

1.2 Environmental Issues

1.2.1 Existing Environment

The pipeline's project area in Hood and Somervell Counties lies within the Cross Timbers and Prairie Ecological Region encompassing all or portions of 35 counties situated in north-central Texas.[1] This complex transitional area of prairie dissected by parallel timbered strips is located in the central portion of the area between three other ecological regions, the Blackland Prairie immediately to the east, the Edwards Plateau and Llano Uplift to the south and the Rolling Plains to the west. The physiognomy of the region is oak and juniper woods and mixed grass prairie. Much of the native vegetation has been displaced by agriculture and development, and range management techniques, including fire suppression, have contributed to the spread of invasive woody species and grasses. Farming and grazing practices have also reduced the abundance and diversity of wildlife in the region.[2] The climate is characterized as subtropical subhumid, with hot summers and dry winters. Average annual precipitation ranges between 28 and 32 inches.[3]

Hood and Somervell counties are located primarily over the outcrops of the Trinity Aquifer, the only major groundwater resource in the two-county area. The Trinity Aquifer is composed of interbedded sandstone, sand, limestone, and shale of Cretaceous Age. This aquifer consists of the Antlers Formation, the Twin Mountains Formation, the Paluxy Formation and the Glen Rose Formation. The Paluxy Formation and the Glen Rose Formation constitute the majority of the outcropping units along the pipeline right-of-way[4]. The Paluxy Formation is

[1] Gould, F.W., G.O. Hoffman, and C.A. Rechenthin, Vegetational Areas of Texas, Texas A&M University, Texas Agriculture Experiment Station Leaflet No. 492, 1960.
[2] Telfair, R.C., "Texas Wildlife Resources and Land Uses," University of Texas Press, Austin, Texas, 1999.
[3] Larkin, T.J., and G.W. Bomar, "Climatic Atlas of Texas," Texas Department of Water Resources, Austin, Texas, 1983.
[4] Bureau of Economic Geology (BEG). "Geologic Atlas of Texas, Dallas Sheet. The University of Texas. 1972, Revised 1988.

characterized by fine-grained, compact, friable, very fine to medium-grained white quartz sand interbedded with sandy, silty, calcareous, or waxy clay and shale. The saturated thickness of this formation can vary considerably and is an important regional water-yielding source providing water for rural domestic and livestock uses in addition to a municipal and industrial water supply.[5] The Glen Rose Formation is predominately limestone with smaller amounts of shale, sandy shale, clay sandstone, marl, and anhydrite. Typical thickness of the Glen Rose ranges from 40 to 200 feet with an approximate thickness of 1,500 feet.[6, 7] Locally, groundwater usage is exclusively for rural domestic and livestock needs. No minor aquifers underlie the project area.

The physiography of the region includes hard sandstone, mud, and mudstone (undifferentiated), ceramic clay and lignite/coal, terraces, and flood-prone areas. The topography ranges from flat to rolling, and from steeply to moderately sloped, with local shallow depressions in flood-prone areas along waterways.[8] The predominant soil associations in the project area are Tarrant-Purves, Windthorst-Duffau and Frio-Bosque. The Tarrant-Purves association consists of very shallow to shallow, undulating to hilly, upland clayey soils formed in limestone on ridgetops and hillsides. The Windthorst-Duffau association is characterized by deep, gently sloping to sloping, loamy and sandy soils formed in loamy sediments or in stratified clayey, sandy, or weakly cemented sandstone along shallow upland valleys and foot slopes. The Frio-Bosque association contains deep, nearly level, clayey and loamy soils, found on floodplains of streams that form over limestone.[9]

[5] Klemt,W.B., R.D. Perkins and H.J. Alvarez. "Ground-water Resources of Part of Central Texas with Emphasis on the Antlers and Travis Peak Formations, Volume 1. Texas Water Development Board Report 195. 1975.
[6] Baker, B., G. Duffin, R. Flores, and T. Lynch. "Evaluation of Water Resources in Part of North-Central Texas. Texas Water Development Board Report 318. 1990.
[7] Nordstrom, P.L. "Occurrence, Availability, and Chemical Quality of Ground Water in the Cretaceous Aquifers of North-Central Texas, Volume 1. Texas Water Development Board Report 269. 1982.
[8] Kier, R.S., L.E. Garner, and L.F. Brown, Jr., "Land Resources of Texas." Bureau of Economic Geology, University of Texas, Austin, Texas, 1977.
[9] Coburn, W.C. *Soil Survey of Hood and Somervell Counties, Texas*, United States Department of Agriculture, Soil Conservation Service, in cooperation with Texas Agricultural Experiment Station, 1978.

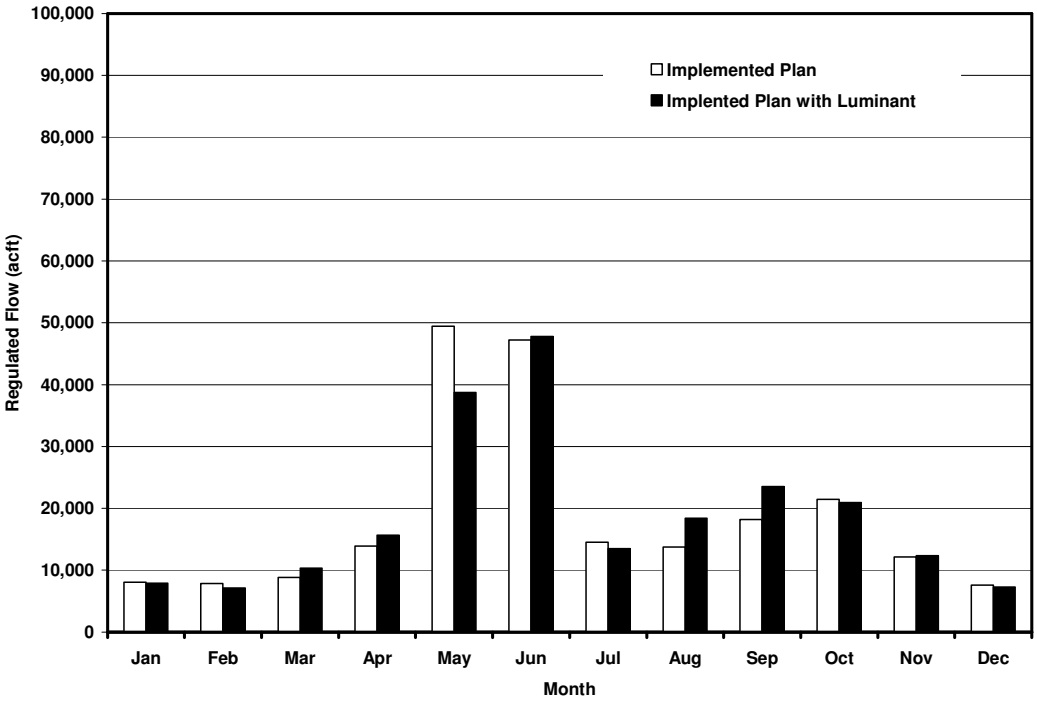

Figure 2. Monthly Median Flows in the Brazos River at Glen Rose.

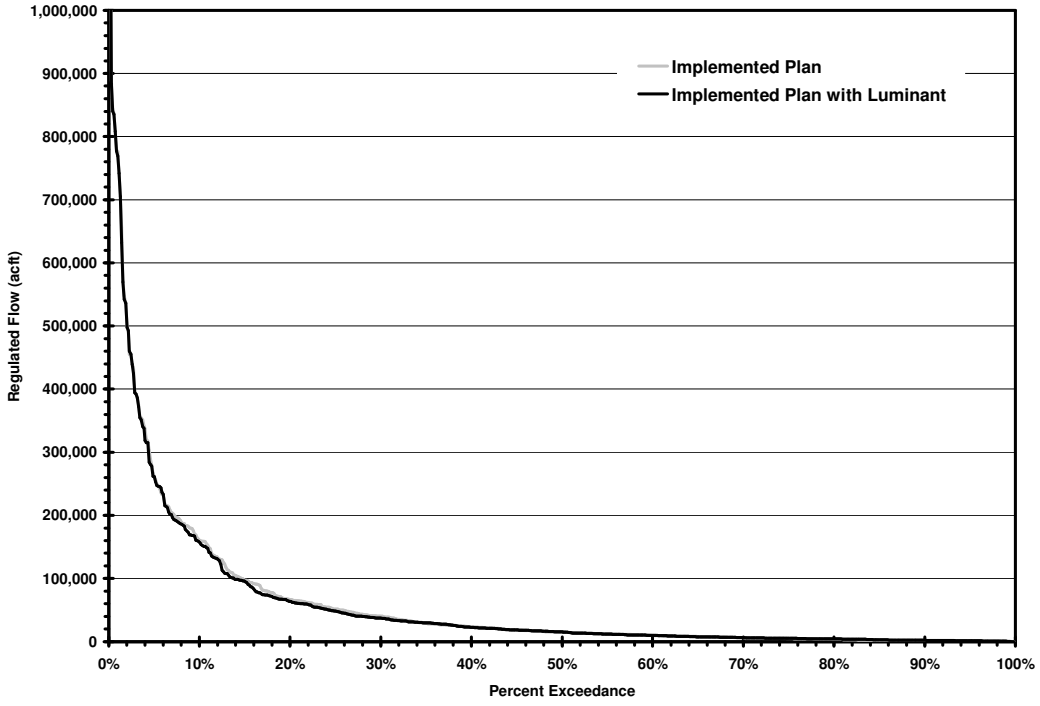

Figure 3. Monthly Flow Frequency in the Brazos River at Glen Rose.

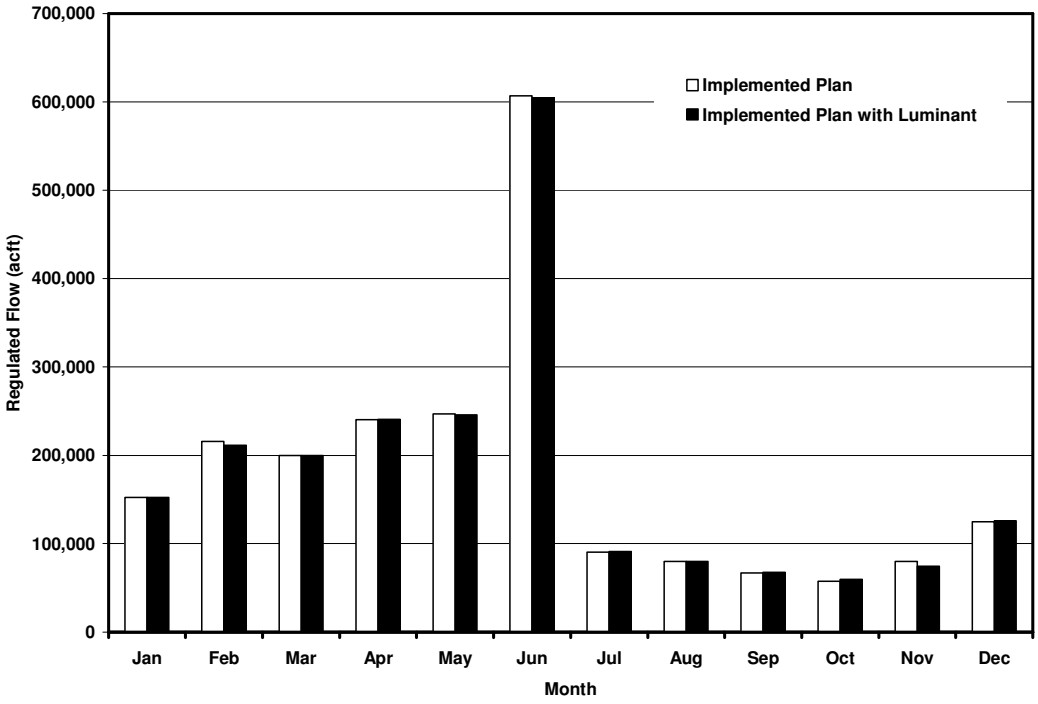

Figure 4. Monthly Median Flows in the Brazos River at Richmond.

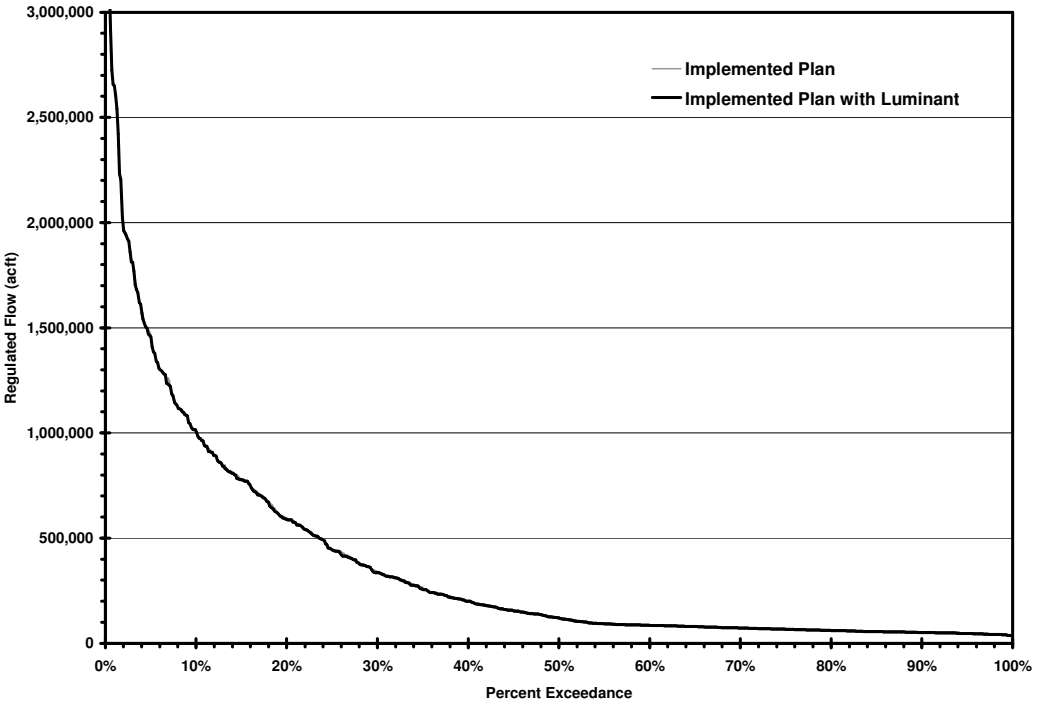

Figure 5. Monthly Flow Frequency in the Brazos River at Richmond.

1.2.1.1 Vegetation Types

Two major vegetation types occur within the general vicinity of the proposed project: Silver Bluestem (*Bothriochloa saccharoides*)–Texas Wintergrass (*Stipa leucotricha*) Grassland and Oaks-Mesquite-Juniper (*Quercus-Prosopis-Juniperus*) Parks/Woods.[10] Variations of these primary types can occur that may involve changes in the composition of woody and herbaceous species and physiognomy according to localized conditions and specific range sites. Silver Bluestem–Texas Wintergrass Grassland could include the following commonly associated plants: little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), Texas grama (*Bouteloua rigidiseta*), three-awn (*Aristida* spp.), hairy grama (*Bouteloua hirsuta*), tall dropseed (*Sporobolus cryptandrus*), buffalograss (*Buchloe dactyloides*), windmillgrass, (*Chloris* spp.), hairy tridens (*Tridens pilosum*), tumblegrass (*Schedonnardus paniculatus*), western ragweed (*Ambrosia psilostachya*), broom snakeweed (*Xanthocephalum* spp.), Texas bluebonnet (*Lupinus texensis*), live oak (*Quercus virginiana*), post oak (*Quercus stellata*), and mesquite (*Prosopis glandulosa*). Commonly associated plants of Oaks-Mesquite-Juniper Parks/Woods are post oak, Ashe juniper (*Juniperus ashei*), shin oak (*Quercus sinuata* var. *breviloba*), Texas oak (*Quercus texana*), blackjack oak (*Quercus marilandica*), live oak, cedar elm, agarito (*Berberis trifoliolata*), soapberry (*Sapindus saponaria*), sumac (*Rhus* spp.), hackberry (*Celtis* spp.), Texas pricklypear (*Opuntia lindheimeri*), Mexican persimmon (*Diospyros virginiana*), purple three-awn (*Aristida purpurea*), hairy grama, Texas grama, sideoats grama, curly mesquite (*Hilaria belangeri*), and Texas wintergrass (*Nasella leucotricha*).

1.2.1.2 Wildlife Species and Habitat

A number of vertebrate species would be expected to occur near the project area as indicated by occurrence records for Hood and Somervell counties.[11] These include one species of salamander, 16 species of frogs and toads, seven species of turtles, 11 species of lizards and skinks, and 29 species of snakes. Additionally, 65 species of mammals could occur within the site or surrounding region,[12] as well as an undetermined number of bird species.

[10] McMahan, C.A., R.F. Frye, and K.L. Brown, "The Vegetation Types of Texas," Texas Parks and Wildlife Department, Wildlife Division, Austin, Texas, 1984.
[11] Texas A&M University (TAMU), "County Records for Amphibians and Reptiles," Texas Cooperative Wildlife Collection, 1998.
[12] Davis, W.B., and D.J. Schmidly, "The Mammals of Texas – Online Edition," Texas Tech University, http://www.nsrl.ttu.edu/tmot1/Default.htm, 1997.

The wildlife habitat types of the project area coincide closely with the major plant community types present. The major habitat divisions are forested (upland woodlands and bottomland woodlands), non-forested (savannah, native and improved pastureland, hayfields, forage crops and right-of-ways), aquatic (marshes, ponds, small streams, and major surface-water developments including Lake Granbury and Squaw Creek Reservoir). The upland forested areas are usually dominated by Ashe juniper, cedar elm (*Ulmus crassifolia*), Texas oak, post oak, mesquite and blackjack oak. Some common wildlife species known to occur within this community type include wild turkey (*Meleagris gallopavo*), American robin (*Turdus migratorius*), Carolina chickadee (*Poecile carolinensis*), downy woodpecker (*Picoides pubescens*), turkey vulture (Cathartes aura), blue jay (*Cyanocitta cristata*), northern cardinal (*Cardinalis cardinalis*), and red-bellied woodpecker (*Melanerpes carolinus*). Additional species of potential occurrence include the white-tailed deer, striped skunk (*Mephitis mephitis*), Virginia opossum (*Didelphis virginiana*), eastern fox squirrel (*Sciurus niger*), nine-banded armadillo (*Dasypus novemcinctus*), white-footed mouse (*Peromyscus leucopus*), Texas spiny lizard (*Sceloporus olivaceus*), eastern yellow-bellied racer (*Coluber constrictor*), Texas rat snake (*Elaphe obsoleta*), western diamondback rattlesnake (*Crotalus atrox*), mourning dove (*Zenaida macroura*), tufted titmouse (*Baeolophus bicolor*), rufous-crowned sparrow (*Aimophila ruficeps*), and the painted bunting (*Passerina ciris*).

Bottomland/riparian forested areas occur in topographic lowlands along major streams and along tributaries at higher elevations. Overstory species include cedar elm, Texas sugarberry (*Celtis laevigata*), pecan (*Carya illinoinensis*), walnut (*Juglans* spp.), American elm (*Ulmus americana*), slippery elm (*Ulmus rubra*), eastern cottonwood (*Populus deltoides*), and scattered Ashe juniper. Terrestrial wildlife species typical of this habitat include beaver (*Castor canadensis*), white-tailed deer, northern raccoon (*Procyon lotor*), black vulture (*Coragyps atratus*), American robin, Carolina chickadee, turkey vulture, northern cardinal and red-bellied woodpecker, Virginia opossum, white-footed mouse, wild turkey, eastern screech-owl (*Megascops asio*), yellow-billed cuckoo (*Coccyzus americanus*), pileated woodpecker, Carolina wren (*Thryothorus ludovicianus*), summer tanager (*Piranga rubra*), eastern pewee (*Contopus virens*), Barn owl (*Tyto alba*), fox squirrel, Texas rat snake, woodhouse's toad (*Bufo woodhousei*), eastern gray treefrog (*Hyla versicolor*), and Strecker's chorus frog (*Pseudacris streckeri*).

The savannah community is a type of grassland with an open tree canopy that forms approximately 10 to 50 percent crown cover. Scattered trees that make up the canopy in these stands typically include Ashe juniper, honey mesquite (*Prosopis glandulosa*), cedar elm, post oak and plateau oak (*Quercus fusiformis*). Dominant grasses and weedy herbaceous species include coastal bermudagrass (*Cynodon dactylon*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), sideoats grama, Texas grama, Texas wintergrass and hairy grama (*Bouteloua hirsuta*). Faunal species inhabiting the savannah community may include the turkey vulture, northern mockingbird ((*Mimus polyglottos*), dark-eyed junco, American kestrel (*Falco sparverius*), loggerhead shrike (*Lanius ludovicianus*), song sparrow (*Melospiza melodia*), mourning dove, Virginia opossum, eastern cottontail (*Sylvilagus floridanus*), nine-banded armadillo, hispid cotton rat (Sigmodon hispidus), plains harvest mouse (*Reithrodontomys montanus*), ornate box turtle (*Terrapene ornata*), Great Plains skink (*Eumeces obsoleta*), Texas rat snake, western diamondback snake, woodhouses' toad, bobwhite (*Colinus virginianus*) red-tailed hawk (*Buteo jamaicensis*), and eastern meadowlark (*Sturnella magna*).

The pastureland community includes native and improved pastures, hayfields, forage crops, and right-of-ways. Improved or managed pastureland is typically dominated by forage crops including bahiagrass (*Paspalum notatum*) and/or bermudagrass. Periodically kleingrass (*Panicum coloratum*) is planted for hay and as a forage grass. Unimproved pastureland and right-of-way areas consist of a variety of grasses, forbs, and woody species. Common grasses found throughout these habitats include little bluestem, sideoats grama, and Indiangrass. Wildlife species that may inhabit the community pastureland include most of those also occurring in the savannah habitat.

Aquatic habitats within the project area right-of-way consist primarily of stock ponds, unnamed tributaries to the Brazos River, Squaw Creek and its tributaries, Squaw Creek Reservoir and Lake Granbury. Plant species common to this habitat may include rushes (*Scirpus* spp.), sedges (*Carex* spp. and *Cyperus* spp.), spikesedges (*Eleocharis* spp.), and cattails (*Typha* spp.). Aquatic fauna may include the belted kingfisher (*Megaceryle alcyon*), great blue heron (*Ardea herodias*), lesser scaup (*Aythya affinis*), beaver, raccoon, and cricket frogs (*Acris* spp.), Virginia opossum, bullfrog (*Rana catesbeiana*), pied-billed grebe (*Podilymbus podiceps*), blue-winged teal (*Anas discors*), and the American widgeon (*Mareca americana*).

1.2.1.3 Aquatic Habitat

The project area is located within the middle segment of the Brazos River Basin in North-Central Texas. All surface drainage in the vicinity of the proposed pipeline follows a general east and southeast course toward the river. As previously mentioned, the major aquatic environments include reservoirs, intermittent streams and small surface water impoundments (stock ponds). The principal tributaries to the Brazos River that will be crossed by the pipeline include Squaw Creek, Panther Branch and several unnamed drainage systems that have direct communication with the main channel of the Brazos River. Distributions and population densities of aquatic assemblages are limited by the types and quality of habitats available. Aquatic biota in most of the project-area streams and ponds is probably severely restricted because of the lack of permanent water.

1.2.2 Potential Impacts

Luminant is proposing to construct two 36-inch diameter and two 42-inch diameter pipelines. The proposed pipelines will tie into Lake Granbury and terminate at the Comanche Peak Station. The entire proposed pipeline alignment, located on the Acton, Nemo, and Hill City 7.5 minute U.S. Geological Survey (USGS) topographic quadrangle maps, is approximately 63,000 feet long. The majority of the pipeline route between Lake Granbury and the vicinity of Squaw Creek Reservoir will parallel an existing pipeline ROW. Approximately half of the new pipeline, positioned along the south and southwest portion of Squaw Creek Reservoir, will be on Luminant property. The final alignment of the proposed pipeline(s) will be selected to avoid or minimize environmental impacts.

1.2.2.1 Vegetation

The anticipated impact of this project to vegetation resulting from site preparation and construction is the removal of existing woody vegetation from the areas required for the ROW. The greatest amount of vegetation clearing would be required in forested areas, while minimal clearing would be necessary in pasturelands. The only land lost to cultivation will be that occurring within the pipeline corridor easement.

Potential for regulatory wetlands is the greatest along the tributaries crossed by the pipeline route. Field investigations would be required to delineate the full extent of waters of the U.S., including wetlands, within the ROW. The United State Army Corps of Engineers

(USACE), Fort Worth District, has the primary regulatory authority for enforcing Section 404 of the Clean Water Act (CWA) requirements. The USACE would provide a verification of the delineation and make the final jurisdictional determination for waters of the U.S. in the ROW during permit negotiations.

1.2.2.2 Wildlife

The impact of construction of the proposed project on terrestrial wildlife and wildlife habitats would vary depending upon the timing of construction and types of construction techniques used, as well as on the requirements of each species and the habitat present where various project components would be constructed. In general, impact on terrestrial wildlife in the area for the new pipeline would be short term and minimal because no sensitive habitats would be affected (as indicated by Luminant based upon field investigations), and much of the area affected by construction would be allowed to revert to the pre-construction habitat type following construction.

Native wildlife habitat adjacent to the proposed project site has been eliminated by prior construction activities as the current ROW vegetation is a mowed grass field. The maintained grassy areas do not provide sufficient habitat to support diverse wildlife populations.

Due to the disturbed nature of the ROW from prior commercial activity associated with the Comanche Peak Station and because the site is mowed on a regular basis, the number and diversity of mammal, bird, reptile, and amphibian species are low and limited. Some species such as rodents, rabbits, lizards and insects may be affected by the construction due to alteration in habitat and direct contact with construction equipment. Those species common along the ROW are well adapted to life within this area and may move away during construction and return once the pipeline has been covered. However, the long-terms effects will be minimal.

The pipeline site is located in the North American flyway and many neo-tropical migrants pass over this area annually. Development of a construction schedule should be timed to minimize impacts to migratory birds during the major fall and spring migrations.

1.2.2.3 Threatened and Endangered Species

A total of 25 species could potentially occur within the vicinity of the site that are state- or federally-listed as threatened or endangered, candidates for listing, or exhibit sufficient rarity to be listed as a species of concern (Table 3). This group includes three reptiles, ten birds, two

mammals, three mollusks, and two fish species. Four bird species federally-listed as threatened or endangered could occur in the project area. These include the black-capped vireo (*Vireo atricapillus*), golden-cheeked warbler (*Dendroica chrysoparia*), interior least tern (*Sterna antillarum athalassos*), and whooping crane (*Grus americana*). These four birds are all seasonal migrants that could pass through the project area but would not likely be directly affected by the proposed pipeline crossing.

A search of the Texas Wildlife Diversity Database (TXNDD)[13] revealed six documented occurrences of the golden-cheeked warbler, six occurrences of the black-capped vireo, one documented occurrence each for the Brazos water snake (*Nerodia harteri*), Comanche Peak prairie-clover (*Dalea reverchonii*), and Glen Rose yucca (*Yucca necopina*) within the project vicinity as noted on representative 7.5-minute quadrangle maps (Nemo, Granbury, Hill City, Acton) that include the project site. The TXNDD has documented a waterbird colony (i.e., rookery) along Squaw Creek and Panther Branch near the upper end of Squaw Creek Reservoir and northwest of the proposed pipeline ROW. The two plant species of concern currently have no regulatory listing status and it is not anticipated that construction activity would create any adverse impact to these species. Confirmed habitat for the golden-cheeked warbler and the black-capped vireo is found 1 mile southwest of the proposed corridor, however, no impacts to these species are expected. The Brazos water snake is known to reside in the Brazos River in the vicinity of the proposed pipeline but is not likely to be found in the streams along the pipeline route due to lack of suitable habitat.

These data are not a representative inventory of rare resources or sensitive sites. Although based on the best information available to Texas Parks and Wildlife Department (TPWD), these data do not provide a definitive statement as to the presence, absence, or condition of special species, natural communities, or other significant features in the project area. Luminant Power has indicated that on-site evaluations have been conducted to investigate the occurrence of sensitive species or habitats, but the results of those evaluations are not yet available. The results of these evaluations will be described in the proposed facility's Construction and Operation License Application (COLA) to be submitted to the Nuclear Regulatory Commission (NRC).

[13] Texas Parks and Wildlife Department (TPWD), Texas Wildlife Diversity Database, February 28, 2008.

1.2.2.4 Aquatic Environments

The potential impacts of this water management strategy were evaluated at two gage locations on the Brazos River: (1) near Glen Rose downstream of the proposed pipeline and (2) near Richmond in the lower portion of the watershed. Monthly streamflows at these two sites are presented in Figures 2 through 5, and Tables 4 and 5. The anticipated impact of this water management strategy on overall flows would be minor when addressed from the perspective of the existing 2006 plan. In general, flows downstream of Lake Granbury, as measured by the Glen Rose gage, would generally be somewhat less than those without the new Luminant diversion; however, flows would increase in some months. These differences are due to how the BRA system of reservoirs responds in the modeling of the BRA System Operations Plan to meet shifting water needs. There would be little difference in flows at the Richmond gage.

It is not likely that this project, alone, would have a substantial influence on total discharge in the Brazos River or to freshwater inflows to the Brazos River estuary where additional flow inputs would moderate the effects. No impacts on endangered or threatened aquatic fauna are anticipated.

Table 3.
Potentially Occurring Species that are Rare or Federal- and State-Listed at the Luminant Pipeline, Hood and Somervell Counties

Scientific Name	*Common Name*	*Federal/State Status*	*Hood County*	*Somervell County*
Birds				
Falco peregrinus anatum	American Peregrine Falcon	DL/E	Migrant	Migrant
Falco peregrinus tundrius	Arctic Peregrine Falcon	DL/T	Migrant	Migrant
Haliaeetus leucocephalus	Bald Eagle	DL/T	Migrant	Migrant
Vireo atricapillus	Black-capped Vireo	LE/E	Migrant	Migrant
Dendroica chrysoparia	Golden-cheeked Warbler	LE/E	Migrant	Migrant
Ammodramus bairdii	Baird's Sparrow	SOC	Migrant	—
Sterna antillarum athalassos	Interior Least Tern	LE/E	Migrant*	Migrant*
Charadrius montanus	Mountain Plover	SOC	Migrant*	Migrant*
Athene cunicularia hypugaea	Western Burrowing Owl	SOC	Migrant*	Migrant*
Grus americana	Whooping Crane	LE/E	Migrant	Migrant
Fishes				
Notropis oxyrhynchus	Sharpnose Shiner	C/SOC	X	X
Notropis buccula	Smalleye Shiner	C/SOC	X	X
Mammals				
Ursus americanus	Black Bear	T/SA;NL/T	X	—
Canis lupus	Gray Wolf	LE/E	Extirpated	Extirpated
Spilogale putorius interrupta	Plains Spotted Skunk	SOC	X	X
Canis rufus	Red Wolf	LE/E	Extirpated	Extirpated
Mollusks				
Tritogonia verrucosa	Pistolgrip	SOC	X	X
Arcidens confragosus	Rock pocketbook	SOC	X	X
Truncilla macrodon	Texas fawnsfoot	SOC	X	X
Reptiles				
Nerodia harteri	Brazos Water Snake	SOC/T	X	X
Thamnophis sirtalis annectens	Texas Garter Snake	SOC	X	X
Phrynosoma cornutum	Texas Horned Lizard	SOC/T	X	X
Crotalus horridus	Timber/Canebrake rattlesnake	SOC/T	X	X
Plants				
Dalea reverchonii	Comanche Peak Prairie-Clover	SOC	X	—
Yucca necopina	Glen Rose Yucca	SOC	X	X

X = Occurs in county; — = does not occur in county; * Nesting migrant; may nest in the county.

Federal Status: LE-Listed Endangered; LT-Listed Threatened; T/SA- Listed Threatened on Basis of Similarity of Appearance; DL-Delisted Endangered/Threatened; NL-Not Listed; C-Candidate (USFWS has substantial information on biological vulnerability and threats to support proposing to list as endangered or threatened. Data are being gathered on habitat needs and/or critical habitat designations); SOC-Species of Concern (some information exists showing evidence of vulnerability, but is not listed).

State Status: E-Listed as Endangered by the State of Texas; T-Listed as Threatened by the State of Texas; SOC-Species of Concern (some information exists showing evidence of vulnerability, but is not listed)

Sources: Texas Parks and Wildlife Department (TPWD) Annotated County List of Rare Species for Hood and Somervell Counties (2007); TPWD Texas Wildlife Diversity Database (2008), United States Fish and Wildlife Service (USFWS), Federally-listed as Threatened and Endangered Species of Texas, February 5, 2008.

1.2.2.5 Cultural Resources

An archeological survey and results of machine-assisted deep testing were provided by Luminant. This work was accomplished between February 11 and 15, 2008, to identify and assess any cultural resources that might be present within all areas to be impacted by the construction of the proposed pipeline. Field investigations entailed an intensive pedestrian surface survey with the excavation of several shovel test pits in surface soil areas along the segments of alternate routes positioned south of Squaw Creek Reservoir and deep trench assessment using a backhoe in five areas across the flood plain of Squaw Creek below the Squaw Creek Reservoir Dam. Ten areas of archeological interest previously identified during a reconnaissance were revisited for evaluation. These sites were determined to be either sufficiently removed from the proposed corridor area or were of little archeological value. Two new areas of archeological interest were encountered during this survey but were not considered to have substantial archeological significance. The entire project area surveyed has been

Table 4.
Median Monthly Streamflow: Brazos River Gage near Glen Rose

Month	*2006 Brazos G Plan (acft/mo)*	*2006 Plan with Luminant (acft/mo)*	*Difference (acft/mo)*	*Percent Reduction*
January	8,042	7,907	-135	-1.7%
February	7,831	7,132	-699	-8.9%
March	8,842	10,314	1,472	16.6%
April	13,891	15,670	1,779	12.8%
May	49,414	38,737	-10,677	-21.6%
June	47,185	47,792	607	1.3%
July	14,535	13,460	-1,074	-7.4%
August	13,732	18,388	4,656	33.9%
September	18,216	23,495	5,279	29.0%
October	21,460	20,929	-532	-2.5%
November	12,161	12,350	189	1.6%
December	7,584	7,309	-275	-3.6%

Table 5.
Median Monthly Streamflow: Brazos River Gage at Richmond

Month	*2006 Brazos G Plan (acft/mo)*	*2006 Plan with Luminant (acft/mo)*	*Difference (acft/mo)*	*Percent Reduction*
January	152,353	152,461	108	0.1%
February	215,567	211,630	-3,937	-1.8%
March	199,589	199,589	0	0.0%
April	240,376	240,841	465	0.2%
May	246,759	245,815	-944	-0.4%
June	606,834	604,515	-2,319	-0.4%
July	90,396	90,927	531	0.6%
August	79,916	79,782	-134	-0.2%
September	66,929	67,512	584	0.9%
October	57,516	59,533	2,016	3.5%
November	79,934	74,373	-5,561	-7.0%
December	124,910	125,850	941	0.8%

extremely disturbed by previous construction and land clearing activities. Sediments along Squaw Creek exceeded the maximum depth of the proposed waterline set at 6 feet but showed no indications of containing buried archeological deposits.

Additionally, a records search of the Texas Archeological Sites Atlas database was conducted on February 20, 2008 to determine the density of archeological sites documented within a 1,000-feet wide corridor (500 feet on either side of the proposed pipeline route) extending approximately 12 miles from Lake Granbury and ending at the Comanche Peak Station. After a review of the United States Geological Survey (USGS) 7.5-minute topographic quadrangle maps for Acton, Hill City and Nemo, the results reveal that one archeological site has been documented within the 500 feet boundary east of the proposed pipeline crossing in Hood County. Site 41SV55 was recorded in 1974 by Southern Methodist University (SMU) and consisted of a prehistoric scatter of lithics and burned rock that had been disturbed by agricultural plowing and vandalism. The present condition of this site is unknown and the site file located at the Texas Archeological Research Laboratory (TARL) consists of location data only. Several other recorded sites appear to lie within 0.31 miles (0.5 kilometers) of the currently proposed route.

None of the cultural resources directly along the pipeline corridor or within the Area of Potential Effect (APE) have potential for significant or important research value nor do they qualify for inclusion applicable to National Register of Historic Places (NRHP) significance criteria or listing as a State Archeological Landmark (SAL). No further archeological investigations are recommended. However, prior to construction of new pipeline, the project must be coordinated with the Texas Historical Commission (THC) to obtain clearance.

Coordination with the THC is ongoing. Based on survey results, Luminant has indicated that there are no significant findings along the pipe line routes. Cultural resources that occur on public lands or within the APE of publicly funded or permitted projects are governed by the Texas Antiquities Code (Title 9, Chapter 191, Texas Natural Resource Code of 1977), the National Historic Preservation Act (PL96-515), and the Archeological and Historic Preservation Act (PL93-291).

1.2.2.6 Threats to Natural Resources

Threats to natural resources include potentially lower streamflows downstream of Lake Granbury, potentially increased salinity levels (total dissolved solids, TDS) in Lake Granbury, and potentially increased temperatures. Downstream flows will be largely unaffected by the addition of the Luminant diversion.

Blowdown water from the cooling towers that would be returned to Lake Granbury will contain essentially the same mass load of TDS as the water originally diverted, but in greater concentrations due to the forced loss of water during the cooling process. In order to obtain a Texas Pollutant Discharge Elimination System (TPDES) discharge permit from the Texas Commission on Environmental Quality, Luminant will likely be required to treat the blowdown water by removing dissolved solids. For this reason, it is assumed that Luminant will be required to treat the blowdown water sufficiently so as to not create salinity levels in Lake Granbury that would constitute a threat to natural resources. The required treatment to remove dissolved solids is not included in this analysis.

Increased temperature in Lake Granbury could pose a threat to natural resources. The blowdown water to be discharged into Lake Granbury will be hotter than the ambient water temperature. Analyses provided by Luminant indicate that this temperature increase would dissipate quickly, and therefore will not increase the overall water temperature in Lake Granbury.

1.3 Engineering and Costing

Summaries of project costs for the diversion and blowdown pipelines are shown in Tables 6 and 7. The total project is estimated to cost $103.9 million for construction of the intake, pump stations, and transmission pipelines necessary to divert supply from Lake Granbury and return the blowdown water back to the reservoir. The annual project costs are estimated to be $15.98 million; this includes annual debt service, operation and maintenance, and annual payment to the Brazos River Authority for the water supply.

1.4 Implementation Issues

This water supply option has been compared to the plan development criteria, as shown in Table 8, and the option meets each criterion.

Table 6.
Cost Estimate Summary
Somervell County Steam Electric Supply from the Brazos River Authority
(Second Quarter 2002 Prices)
Cooling Tower Supply Pipeline

Item	*Estimated Costs for Facilities*
Capital Costs	
Intake and Pump Station (92.6 MGD)	$22,318,000
Transmission Pipeline (42 in dia., 12 miles)	$25,548,000
Total Capital Cost	**$47,866,000**
Engineering, Legal Costs and Contingencies	$15,476,000
Environmental & Archaeology Studies and Mitigation	$602,000
Land Acquisition and Surveying (121 acres)	$265,000
Interest During Construction (2 years)	$5,137,000
Total Project Cost	**$69,346,000**
Annual Costs	
Debt Service (6 percent, 30 years)	$5,038,000
Operation and Maintenance	
Intake, Pipeline, Pump Station	$813,000
Pumping Energy Costs (59775328 kW-hr @ 0.06 $/kW-hr)	$3,587,000
Purchase of Water (76270 acft/yr @ 45.75 $/acft)	$3,489,000
Total Annual Cost	**$12,927,000**
Available Project Yield (acft/yr)	103,717
Annual Cost of Water ($ per acft)	$125
Annual Cost of Water ($ per 1,000 gallons)	$0.38

Table 7.
Cost Estimate Summary
Somervell County Steam Electric Supply from the Brazos River Authority
(Second Quarter 2002 Prices)
Cooling Tower Blowdown Pipeline

Item	*Estimated Costs for Facilities*
Capital Costs	
Intake and Pump Station (37.6 MGD)	$3,333,000
Transmission Pipeline (36 in dia., 12.6 miles)	$20,469,000
Total Capital Cost	**$23,802,000**
Engineering, Legal Costs and Contingencies	$7,307,000
Environmental & Archaeology Studies and Mitigation	$634,000
Land Acquisition and Surveying (92 acres)	$265,000
Interest During Construction (2 years)	$2,561,000
Total Project Cost	**$34,569,000**
Annual Costs	
Debt Service (6 percent, 30 years)	$2,511,000
Operation and Maintenance	
Intake, Pipeline, Pump Station	$288,000
Pumping Energy Costs (4297887 kW-hr @ 0.06 $/kW-hr)	$258,000
Total Annual Cost	**$3,057,000**
Available Project Yield (acft/yr)	42,100
Annual Cost of Water ($ per acft)	$73
Annual Cost of Water ($ per 1,000 gallons)	$0.22

Note: Costs related to treatment of blowdown water (desalination) are not considered.

Table 8.
Comparison of Somervell County Steam Electric Supply from the Brazos River Authority to Plan Development Criteria

Impact Category	*Comment(s)*
A. Water Supply	
1. Quantity	1. Sufficient to meet needs
2. Reliability	2. High reliability
3. Cost	3. Reasonable
B. Environmental factors	
1. Environmental Water Needs	1. Low impact
2. Habitat	2. Low to moderate impact
3. Cultural Resources	3. Low to moderate impact
4. Bays and Estuaries	4. Low impact
5. Threatened and Endangered Species	5. Low impact
6. Wetlands	6. Low impact
C. Impact on Other State Water Resources	• Low to moderate impact on salinity levels in Lake Granbury, depending on TPDES discharge permit requirements; no effect on navigation
D. Threats to Agriculture and Natural Resources	• Low to none
E. Equitable Comparison of Strategies Deemed Feasible	• Option is considered to meet industrial shortages
F. Requirements for Interbasin Transfers	• Not applicable
G. Third Party Social and Economic Impacts from Voluntary Redistribution	• None

1.4.1 Potential Regulatory Requirements

- Texas Commission on Environmental Quality (TCEQ) System Operations Permit will need to be obtained by the Brazos River Authority;
- U.S. Army Corps of Engineers Permits will be required for discharges of dredge or fill into wetlands and waters of the U.S. for dam construction, and other activities (Section 404 of the Clean Water Act);
- TCEQ-administered Texas Pollutant Discharge Elimination System (TPDES) Storm Water Pollution Prevention Plan;
- TCEQ-administered TPDES discharge permit for return of blowdown water to Lake Granbury;
- General Land Office (GLO) Easement if State-owned land or water is involved; and,
- Texas Parks and Wildlife Department (TPWD) Sand, Shell, Gravel and Marl permit if State-owned streambed is involved.

1.4.2 State and Federal Permits may Require the Following Studies and Plans

- Environmental impact or assessment studies. Luminant indicates that that these studies have been completed, with the final report under preparation;
- Wildlife habitat mitigation plan that may require acquisition and management of additional land;
- Flow releases downstream to maintain aquatic ecosystems;
- Assessment of impacts on Federal- and State-listed endangered and threatened species; and,
- Cultural resources studies to determine resources impacts and appropriate mitigation plan that may include cultural resource recovery and cataloging; requires coordination with the Texas Historical Commission. Luminant indicates that these studies have been completed and contemplate that no further action will be required.

1.4.3 Land Acquisition Issues

- Additional width of easement on land not owned by Luminant may be required.

4C.30 Somervell County Water Supply Plan

Table 4C.30-1 lists each water user group in Somervell County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.30-1.
Somervell County Surplus/(Shortage)

Water User Group	*Surplus/(Shortage)*[1]		*Comment*
	2030 (acft/yr)	*2060 (acft/yr)*	
City of Glen Rose	38	37	Projected surplus
County-Other	(231)	(260)	Projected shortage – see plan below
Manufacturing	(4)	(7)	Projected shortage – see plan below
Steam-Electric	(36,047)	(36,107)	Projected shortage – see plan below
Mining	(94)	(85)	Projected shortage – see plan below
Irrigation	945	953	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables C-59 and C-60, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.30.1 The City of Glen Rose

4C.30.1.1 Description of Supply

The City of Glen Rose obtains groundwater from the Trinity Aquifer. No shortage is projected for the City of Glen Rose. However, Glen Rose may obtain supplemental surface water supplies from the Somervell County Water Supply Project.

4C.30.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to supplement existing supplies for the City of Glen Rose:

- Somervell County Water Supply Project – the project will treat raw water from Wheeler Branch Off-Channel Reservoir and transmit the treated water to customers of the Somervell County Water District.

4C.30.1.3 Costs

Costs of the Somervell County Water Supply Project are discussed in Section 4C.30.2.3 below.

Table 4C.30-1.
Recommended Plan Costs by Decade for the City of Glen Rose

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	57	46	38	36	36	37
Somervell County Water Supply Project (Phases 1 – 4)*						
Supply From Plan Element (acft/yr)	340	340	340	340	340	340
Annual Cost ($/yr)	$808,188	$808,188	$808,188	$143,974	$143,974	$143,974
Unit Cost ($/acft)	$2,377	$2,377	$2,377	$423	$423	$423
Somervell County Water Supply Project (Phases 5 – 13)*						
Supply From Plan Element (acft/yr)	–	–	260	260	260	260
Annual Cost ($/yr)	–	–	$249,488	$249,488	$249,488	$44,402
Unit Cost ($/acft)	–	–	$960	$960	$960	$171

* Note: This supply is from the Wheeler Branch Reservoir, which has been implemented. The project is for development of treatment and transmission facilities.

4C.30.2 County-Other

4C.30.2.1 Description of Supply

Somervell County-Other obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Somervell County-Other is projected to have a shortage of 231 acft/yr in the year 2030 and 260 acft/yr in the year 2060.

4C.30.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Somervell County-Other:

- Wheeler Branch Off-Channel Reservoir – the project has obtained a water rights permit from the TCEQ and is projected to be completed by 2010
- Somervell County Water Supply Project – the project will treat raw water from Wheeler Branch Off-Channel Reservoir and transmit the treated water to customers of the Somervell County Water District.

- Conservation was also considered; however, the County-Other's per capita use rate is below the selected target rate of 140 gpcd.

4C.30.2.3 Costs

Costs of the Recommended Plan for Somervell County-Other.

a. Wheeler Branch Off-Channel Reservoir:
   - Cost Source: Volume II, Section 4B.13.3
   - Date to be Implemented: before 2010
   - Total Project Cost: $27,195,000
   - Annual Cost: $2,117,000

b. Somervell County Water Supply Project:
   - Cost Source: Somervell County Water District
   - Date to be Implemented: before 2010, with future phases
   - Total Project Cost: $87,226,800 (Phases 1 – 13). (Excluding retail distribution, the cost is $35,159,900.)
   - Annual Cost: $7,659,700 (Phases 1 – 13). (Excluding retail distribution, the annual cost is $3,109,800.)

Table 4C.30-2.
Recommended Plan Costs by Decade for Somervell County-Other

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(133)	(189)	(231)	(251)	(257)	(260)
Wheeler Branch Off-Channel Reservoir						
Supply From Plan Element (acft/yr)	1,800	1,800	1,800	1,800	1,800	1,800
Annual Cost ($/yr)	$2,117,000	$2,117,000	$2,117,000	$2,117,000	$2,117,000	$2,117,000
Unit Cost ($/acft)	$1,176	$1,176	$1,176	$1,176	$1,176	$1,176
Somervell County Water Supply Project (Phases 1 – 4)*						
Supply From Plan Element (acft/yr)	200	200	200	200	200	200
Annual Cost ($/yr)	$475,405	$475,405	$475,405	$84,690	$84,690	$84,690
Unit Cost ($/acft)	$2,377	$2,377	$2,377	$423	$423	$423
Somervell County Water Supply Project (Phases 5 – 13)*						
Supply From Plan Element (acft/yr)	–	–	516	516	516	516
Annual Cost ($/yr)	–	–	$495,138	$495,138	$495,138	$88,120
Unit Cost ($/acft)	–	–	$960	$960	$960	$171

* Note: This supply is from the Wheeler Branch Reservoir, which has been implemented. The project is for development of treatment and transmission facilities.

4C.30.3 Manufacturing

4C.30.3.1 Description of Supply

Somervell County Manufacturing obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Somervell County Manufacturing is projected to have a shortage of 4 acft/yr in the year 2030 and 7 acft/yr in the year 2060.

4C.30.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Somervell County Manufacturing:

- Conservation, and
- Purchase water from the City of Glen Rose.

4C.30.3.3 Costs

Costs of the Recommended Plan for Somervell County Manufacturing.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Water Supply from City of Glen Rose:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2010
   - Annual Cost: $16,161 in 2060

   The annual cost was calculated by multiplying the Manufacturing projected supply from this strategy by an estimated wholesale water rate of $162/acft.

Table 4C.30-3.
Recommended Plan Costs by Decade for Somervell County Manufacturing

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(2)	(3)	(4)	(5)	(6)	(7)
Conservation						
Supply From Plan Element (acft/yr)	0	0	1	1	1	1
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Water Supply from City of Glen Rose						
Supply From Plan Element (acft/yr)	10	10	10	10	10	10
Annual Cost ($/yr)	$16,161	$16,161	$16,161	$16,161	$16,161	$16,161
Unit Cost ($/acft)	$162	$162	$162	$162	$162	$162

4C.30.4 Steam-Electric

4C.30.4.1 Description of Supply

Somervell County Steam-Electric obtains its water supply from Squaw Creek Reservoir and from the Brazos River Authority from Lake Granbury. Somervell County Steam-Electric is projected to have a shortage of 36,047 acft/yr in 2030 and 36,107 acft/yr in 2060. Potable water for plant staff and high-quality process water for boiler feed at the Comanche Peak Steam Electric Station is currently provided from local groundwater. When the Somervell County Water Supply Project is developed, some potable water and process water for the plant will be obtained from the project. Additional future water supplies will come from additional water supply from the Brazos River Authority.

4C.30.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to supplement existing supplies for Somervell County Steam-Electric:

- Somervell County Steam Electric Supply from the Brazos River Authority.
- Somervell County Water Supply Project – the project will treat raw water from Wheeler Branch Off-Channel Reservoir and transmit the treated water to customers of the Somervell County Water District.

- Conservation was also considered; however, the Somervell County Steam-Electric is already exercising substantial conservation.

4C.30.4.3 Costs

Cost of the Recommended Plan for Somervell County Steam-Electric:

a. Water Supply from the Somervell County Steam Electric Supply from the Brazos River Authority:
   - Cost Source: Strategy Evaluation of Proposed Amendment
   - Date to be Implemented: By year 2020
   - Annual Cost: $15,980,000 in 2030

b. Costs of the Somervell County Water Supply Project are discussed in Section 4C.30.2.3 above.

Table 4C.30-4.
Recommended Plan Costs by Decade for Somervell County Steam-Electric

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	25,610	(36,027)	(36,047)	(36,067)	(36,087)	(36,107)
Somervell County Steam Electric Supply from the Brazos River Authority						
Supply From Plan Element (acft/yr)	–	103,717	103,717	103,717	103,717	103,717
Annual Cost (million $/yr)	–	$15.98	$15.98	$15.98	$8.44	$8.44
Unit Cost ($/acft)	–	$154	$154	$154	$81	$81
Somervell County Water Supply Project (Phases 1 – 4)*						
Supply From Plan Element (acft/yr)	300	300	300	300	300	300
Annual Cost ($/yr)	$713,107	$713,107	$713,107	$127,036	$127,036	$127,036
Unit Cost ($/acft)	$2,377	$2,377	$2,377	$423	$423	$423
Somervell County Water Supply Project (Phases 5 – 13)*						
Supply From Plan Element (acft/yr)	–	–	184	184	184	184
Annual Cost ($/yr)	–	–	$176,561	$176,561	$176,561	$31,423
Unit Cost ($/acft)	–	–	$960	$960	$960	$171

* Note: This supply is from the Wheeler Branch Reservoir, which has been implemented. The project is for development of treatment and transmission facilities.

4C.30.5 Mining

4C.30.5.1 Description of Supply

Somervell County Mining obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Somervell County Mining is projected to have a shortage of 94 acft/yr in the year 2030 and 85 acft/yr in the year 2060.

4C.30.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Somervell County Mining:

- Conservation, and
- Voluntary Redistribution from Steam-Electric.

4C.30.5.3 Costs

Costs of the Recommended Plan for Somervell County Mining.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Voluntary Redistribution from Steam-Electric:
   - Cost Source: assumed unit cost for raw water transfer between entities
   - Date to be Implemented: before 2010
   - Unit Cost: $75/acft
   - Annual Cost: $11,250

Table 4C.30-4.
Recommended Plan Costs by Decade for Somervell County Mining

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(106)	(98)	(94)	(91)	(88)	(85)
Conservation						
Supply From Plan Element (acft/yr)	9	14	19	19	18	18
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Voluntary Redistribution from Steam-Electric						
Supply From Plan Element (acft/yr)	150	150	150	150	150	150
Annual Cost ($/yr)	$11,250	$11,250	$11,250	$11,250	$11,250	$11,250
Unit Cost ($/acft)	$75	$75	$75	$75	$75	$75

4C.30.6 Irrigation

Somervell County Irrigation is projected to have a surplus of water through 2060 and no changes in water supply are recommended.

4C.30.7 Livestock

No shortages are projected for Somervell County Livestock and no changes in water supply are recommended.

4C.38.10 Palo Pinto County Municipal Water District No. 1

4C.38.10.1 Description of Supply

Palo Pinto County MWD No. 1 obtains its water supply from Lake Palo Pinto. Based on the available surface water supply, Palo Pinto County MWD No. 1 is projected to have a surplus of 396 acft/yr in the year 2010 and a shortage of 1,821 acft/yr in the year 2060.

4C.38.10.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the Palo Pinto County MWD No. 1:

- **Turkey Peak Reservoir (Volume II, Section 4B.12.5)**
  This project would restore permitted storage in the Lake Palo Pinto System, thus restoring existing permitted yield.
- **Alternative: Lake Palo Pinto Off-Channel Reservoir (Volume II, Section 4B.13.6)**

4C.38.10.3 Costs

Costs of the Recommended Plan for the Palo Pinto County MWD No. 1.

a. Turkey Peak Reservoir:
   - Cost Source: Volume II, Section 4B.12.5
   - Date to be Implemented: before 2020
   - Total Project Cost: $46,150,000
   - Annual Cost: $3,401,000

Table 4C.38-8.
Recommended Plan Costs by Decade for the Palo Pinto County MWD No. 1

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	396	(59)	(492)	(879)	(1,328)	(1,821)
Turkey Peak Reservoir						
Supply From Plan Element (acft/yr)	—	8,648	8,648	8,648	8,648	8,648
Annual Cost (million $/yr)	—	$3.401	$3.401	$3.401	$3.401	$3.401
Unit Cost ($/acft)	—	$393	$393	$393	$393	$393