Appendix A - Table of Contents

Pittsburg Water Conservation and Emergency Demand Management Plan.
Prepared for the City of Pittsburg**.**

Pecan Gap Comprehensive Plan.
Prepared for the City of Pecan Gap by Hayter Engineering, Inc., Paris, Texas, 1996.

Mount Vernon Master Plan.
Prepared for the City of Mt. Vernon.

Gafford Chapel Water Supply Corporation Determining Water Use and Future Demand.
Prepared for the Gafford Chapel Water Supply Corporation by Hayter Engineering, Inc, Paris, Texas, 1999.

Shirley Water Supply Corporation Engineering Report on Water Improvements.
Prepared for the Shirley Water Supply Corporation by Augeier, Martin & Associates.

Sulphur Springs Surface Water Treatment Assessment Study.
Prepared for the City of Sulphur Springs by Black & Veach, 1991.

Deport Comprehensive Plan.
Prepared for the City of Deport by Hayter Engineering, Inc., Paris, Texas, May, 1992.

Lamar County Water Supply District Master Plan.
Prepared for the LCWSD by Hayter Engineering, Inc., Paris, Texas, 1991.

Petty Emergency Water Demand Plan.
Prepared for the City of Petty

Detroit Comprehensive Plan.
Prepared for the City of Detroit by Hayter Engineering, Inc. Paris, Texas, March, 1992.

410 Water Supply Corporation Master Plan.
Prepared for the 410 WSC by Hayter Engineering, Inc., Paris, Texas, 1999.

City of Mt. Pleasant Water System Study.
Prepared for the City of Mt. Pleasant by Bucher, Willis, & Ratliff.

City of Mt. Pleasant Water Treatment Plant Study.
Prepared for the City of Mt. Pleasant by W.T. Ballard, P.E.

City of Talco Comprehensive Plan.
Prepared for the City of Talco, 1999.

Tri Water Supply Corporation Master Plan.
Prepared for the Tri Water Supply Corporation, 1999.

City of Caddo Mills Community Development Plan, Vol II.
Prepared for the City of Caddo Mills by Tim F. Glendening & Associates.

Evaluation of Available Water Supply on Cowleach Fork.
Prepared by Freese & Nichols, 1999.

Lone Oak Water System Study.
Prepared for the City of Lone Oak by Hayter Engineering, Inc., Paris, Texas, 1992.

Avery Comprehensive Plan.
Prepared for the City of Avery by Hayter Engineering, Inc., Paris, Texas, October, 1993.

Celeste Comprehensive Plan.
Prepared for the City of Celeste by Hayter Engineering, Inc., Paris, Texas , 1991.

Clarksville Comprehensive Plan.
Prepared for the City of Clarksville by Taylor Consulting Associates, Inc. & R.I.M. Enterprises, Inc., 1992.

Commerce Comprehensive Plan.
Prepared for the City of Commerce by J. T. Dunkin & Associates, Inc., 1994.

Edgewood Comprehensive Plan.
Prepared for the City of Edgewood by Hayter Engineering, Inc., Paris, Texas, October, 1995.

Neylandville Comprehensive Plan.
Prepared for the City of Neylandville by Hayter Engineering, Inc., Paris, Texas, March, 1997.

Wolfe City Water System Study.
Prepared for the City of Wolfe City by Hayter Engineering, Inc., Paris, Texas, April, 1991.

Point Water System Analysis.
Prepared for the City of Point by Hayter Engineering, Inc., Paris, Texas, March, 1992.

Alba Comprehensive Plan.
Prepared for the City of Alba.

Golden Water Supply Corporation Water Conservation and Emergency Water Demand Management Plan.
Prepared for the Golden Water Supply Corporation by Hayter Engineering, Inc., Paris, Texas, December, 1998.

DeKalb Water Conservation and Emergency Demand Management Plan.
Prepared for the City of DeKalb by Hayter Engineering, Inc., Paris, Texas, July, 1999.

Charleston Water Supply Corporation Master Plan.
Prepared for the Charleston Water Supply Corporation by Hayter Engineering, Inc., Paris, Texas, 1994.

Commerce Water Reuse Plan.

Prepared for the City of Commerce by Hayter Engineering, Inc., Paris, Texas, September, 1992.

Commerce Water Study.
Prepared for the City of Commerce by Hayter Engineering, Inc., Paris, Texas, 1993.

Como Comprehensive Master Plan.
Prepared for the City of Como by Hayter Engineering, Inc., Paris, Texas, 1994.

Cooper Comprehensive Plan.
Prepared for the City of Cooper by Hayter Engineering, Inc, Paris, Texas, 1998.

Water Distribution System Analysis for the City of Reno.
Prepared for the City of Reno by Hayter Engineering, Inc., Paris, Texas 1994.

City of Paris Water System Study.
Prepared for the City of Paris by Bucher, Willis, & Ratliff, April, 1991.

Feasibility Report for Water Treatment and Transmission Facilities – Delta County Municipal Utility District.
Prepared for the Delta County Municipal Utility District by Hayter Engineering, Inc., Paris, Texas September, 1995.

Preliminary Engineering Report.
Prepared for the North Hunt Water Supply Corporation by D. W. Johnston & Associates, Rockwall, Texas, 1994.

Water Treatment and Supply Study.
Prepared for the City of Greenville by City Staff, February, 1991.

Commerce Water Conservation and Drought Contingency Plan.
Prepared for the City of Commerce, 1991.

Water System Analysis and Plan.
Prepared for the City of Clarksville.

Water Conservation and Drought Contingency Plan.
Prepared for the City of Sulphur Springs, July, 1999.

Miller Grove Water Supply Corporation Summary Engineering Report.
Prepared for Miller Grove Water Supply Corporation

Drought Management and Contingency Plan.
Prepared for Cypress Springs Water Supply Corporation, April, 1999.

City of Redwater Water System Analysis.
Prepared for the City of Redwater by NRS Consulting Engineers.

Preliminary Study of Sources of Additional Water Supply, Volume 1 – Report and Volume II – appendices, North Texas Municipal Water District.

Prepared for the North Texas Municipal Water District by Freese and Nichols, Inc., Forth Worth, Texas, May, 1996.

Comprehensive Plan for the City of Sulphur Springs, Texas.

Prepared by Kindle, Stone, & Associates, Inc.

Evaluation of the Long Range Alternatives for Water Treatment, City of White Oak, Texas.

Prepared for the City of White Oak, Texas by Dunn Engineering Company, Longview, Texas, November 1997.

Feasibility Study, Lake O' The Pines South Side Regional Water Supply System.

Prepared for the Northeast Texas Municipal Water District, City of Longview, Bi-County Water Supply Corporation, Diana Water Supply Corporation, City of East Mountain, Glenwood Water Supply Corporation, Gum Springs Water Supply Corporation, City of Hallsville, Harleton Water Supply Corporation, City of Ore City, Tryon Road Water Supply Corporation, and West Harrison Water Supply Corporation by KSA Engineers, Inc., East Texas Engineers, Inc., and NRS Consulting Engineers, Longview, Texas, December 1998.

Feasibility Study for Water Supply from Lake O' The Pines, City of Longview.

Prepared for the City of Longview, Texas by KSA Engineers, Inc., Longview, Texas, March 1995.

Master Plan, Golden Water Supply Corporation.

Prepared for Golden Water Supply Corporation by Hayter Engineering, Inc., Paris, Texas, April 1998.

Preliminary Engineering Report for the City of East Mountain Water System Improvements.

Prepared for the City of East Mountain, Texas by NRS Consulting Engineers, Longview, Texas, December 1993.

Preliminary Engineering Report for Diana Water Supply Corporation Water System Improvements.

Prepared for Diana Water Supply Corporation by KSA Engineers, Inc., Longview, Texas, October, 1993.

Preliminary Engineering Report for Fouke Water Supply Corporation Water System Improvements.

Prepared for Fouke Water Supply Corporation by NRS Consulting Engineers, Longview, Texas, October 1996.

Preliminary Engineering Report for Lake Fork Water Supply Corporation Water System Improvements.

Prepared for Lake Fork Water Supply Corporation by NRS Consulting Engineers, Longview, Texas, November 1993.

Raw Water Demand Projections, City of Longview and Longview Customers.
Prepared for the City of Longview, Texas by HDR Engineering, Inc., Austin, Texas, October 1991.

1996 System Appraisal & Value Analysis Related to City of Marshall Annexation.
Prepared for Leigh Water Supply Corporation by NRS Consulting Engineers, Longview, Texas, August 1996.

Ten Year Water System Improvements Plan, West Gregg Water Supply Corporation.
Prepared for the West Gregg Water Supply Corporation by KSA Engineers, Inc., Longview, Texas, August 1997.

Water and Sewer System Preliminary Engineering Report, City of Linden, Texas.
Prepared for the City of Linden, Texas by NRS Consulting Engineers, Texarkana, Arkansas, Revised October 1998.

Water Conservation and Emergency Water Demand Management Plan, Golden Water Supply Corporation.
Prepared for Golden Water Supply Corporation by Hayter Engineering, Inc., Paris, Texas, July 1999.

Water Conservation Plan and Drought Contingency Plan, Diana Water Supply Corporation.
Prepared for Diana Water Supply Corporation by KSA Engineers, Inc., Longview, Texas, April 1992.

Water Distribution System Analysis, City of Longview, Texas.
Prepared for the City of Longview, Texas by KSA Engineers, Inc., Longview, Texas, April 1998.

Water Supply Report, City of Gilmer, Texas.
Prepared for the City of Gilmer, Texas by NRS Consulting Engineers, Texarkana, Arkansas, January 1999.

Water System Study, Glenwood Water Supply Corporation.
Prepared for the Glenwood Water Supply Corporation by East Texas Engineers, Inc., Longview, Texas, April 1994.

Water System Study, Gum Springs Water Supply Corporation.
Prepared for Gum Springs Water Supply Corporation by East Texas Engineers, Inc., Longview, Texas, December 1997.

Water System Study, Harleton Water Supply Corporation.
Prepared for Harleton Water Supply Corporation by NRS Consulting Engineers, Longview, Texas, March 1993.

Able Springs Water Conservation and Drought Management Plan.
Prepared for Able Springs Water Supply Corporation

Report on Feasibility of Substitution of Reclaimed Water for Potable Water and/or Freshwater .

Prepared by Scott Drake, Director of Public Works for City of Willis Point, Van Zandt County.

Report on Water Production Capacity .

Prepared by Kirk R. Bynum, The Brannon Corporation for South Tawakoni Water Supply Corporation, Van Zandt County.

Preliminary Engineering Report .

Prepared by Daniel & Brown Inc. for Ben Wheeler Water Supply Corporation, Van Zandt & Smith Counties.

Report on the Estimated Cost of Supplying Water to Sulphur Springs.

Prepared by Wisenbaker Fix & Associates for Franklin county Water District, Mount Vernon, Texas, 1968.

Water Supply and Treatment Facilities.

Prepared by Henningson Durham and Richards for the City of Sulphur Springs, Texas, 1963.

Report on Langford Creek Lake.

Prepared by Wisenbaker Fix & Associates for the City of Clarksville, Texas, 1958.

Preliminary Report on Paris Dam and Reservoir, Sanders Creek, Lamar County, Texas.

Prepared by Forrest and Cotton Inc. for the City of Paris, 1960.

Cooper Reservoir Water Supply Study.

Prepared by Black & Veatch for the City of Sulphur Springs, Texas, 1988.

Water Supply Study.

Prepared by Henningson Durham and Richardson for the City of Longview, 1974.

Gregg County Water Quality Management Implementation Plan.

Prepared by B.L. Nelson & Associates for the Middle Sabine River Basin, 1972.

Report on Longivew Municipal Lake on Tiawichi Creek and Cherokee Bayou, Sabine River Basin, Rusk County, Texas.

Prepared by Forrest and Cotton, Inc. for presentation at the public hearing on Application 2774, Texas Water Rights Commission, Austin, Texas, 1970.

Water Supply Study.

Prepared by Kindle Stone and Associates Inc. for the City of Marshall, 1979.

Projected Water Needs for Marshall and Harrison County, Texas, as Related to Available Water Supplies.

Prepared by Lockwood, Andrews and Newman Inc.

Comprehensive Plan for Water and Sewer.
Prepared by B.L. Nelson & Associates for Gregg County, 1960.

Water Quality Management Implementation Plan, Middle Sabine River Basin.
Prepared by B.L. Nelson & Associates for Gregg County, 1972.

Preliminary Report on the Kilgore Dam Reservoir Wilds Creek.
Prepared by Forrest and Cotton, Inc, for Rush, Gregg, and Smith Counties, Texas, 1960.

An Analysis of the Significant Factors Concerning the Construction of a Lake In Franklin County, Texas.
Prepared for Franklin County, Texas.

Comprehensive Water and Sewer Plan: Lamar County, Texas.
Prepared by Hayter Engineering, Inc., 1967.

A Public Water Supply Protection Strategy.
Prepared by Brad L. Cross, geologist; David P. Terry, environmental scientist; David D. Beard, engineer technician for Maloy Water Supply Corporation, 1992.

Comprehensive Area-Wide Water and Sewer Plan.
Prepared by Vance W. King for Delta County, 1968.

Intensive survey of Rock Creek, Hopkins County: Hydrology, Field Measurements, Water Chemistry, Benthal Oxygen demand, Fecal Coliforms.
Prepared by Richard Orman Respress for Hopkins County, 1980.

Comprehensive Plan for Water and Sewer.
Prepared by B.L. Nelson & Associates for Hopkins County, 1970.

Engineering Report on Development of a Supply of Water.
Prepared by Knowlton-Ratliff-English-Collins for the City of Mount Pleasant, Texas from the proposed Titus County Reservoir on Big Cypress Creek, Texas, 1971.

A Public Water Supply Protection Strategy.
Prepared by John Jasek for the Rosewood Water Supply corporation, 1998.

The Country Club Estates; a Public Water Supply Protection Strategy.
Prepared by Brad L. Cross, David P. Terry, and Kenneth D. May, 1997.

Comprehensive Plan for Water and Sewer.
Prepared by B.L. Nelson & Associates for Upshur County.

Plan Summary Report for the Cypress Creek Basin Water Quality Management Plan.
Prepared by Northeast Texas Municipal Water District for Texas Department of Water Resources, 1978.

Water Quality Management Plan for the Cypress Basin.
Prepared by Northeast Texas Municipal Water District, 1975.

Plan Summary Report for the Cypress Creek Basin Water Quality Management Plan.
Prepared by Northeast Texas Municipal Water District for Texas Department of Water Resources, 1981.

Water Quality Management Plant for the Cypress Basin.
Prepared by Northeast Texas Municipal Water District, 1975.

Engineering Report.
Prepared by Wyatt C. Hendrick Consulting Engineer for the Northeast Texas Municipal Water District, Daingerfield, Texas, 1962.

Report on Lower Blundell Creek Dam and Reservoir on Blundell Creek, Cypress Creek Basin, Titus County, Texas.
Prepared by Forrest and Cotton, Inc., 1970.

Update of the Master Plan.
Prepared by Espey Huston & Associates for the Sabine River and Tributaries in Texas, 1985.

Lake Fork Dam and Reservoir on Lake Fork Creek, Sabine River Basin, Wood, Rains, and Hopkins Counties, Texas.
Prepared by URS/Forrest and Cotton, Inc., 1974.

Water System Study
Ten Year Master Plan for East Mountain, Texas
Prepared by NRS Consulting Engineers, Longview, Texas 1999.

Bright Star-Salem WSC Water Conservation and Drought Contingency Plan
Prepared for Bright Star-Salem WSC by Hayter Engineering, Inc., Paris, Texas, 2000.

Commerce Drought Contingency Plan.
Prepared for City of Commerce by Hayter Engineering, Inc., Paris, Texas, 2002.

Dekalb Water Distribution Systems Improvement
Prepared for the City of Dekalb by Hayter Engineering, Inc., Paris, Texas, 2002

Delta County Municipal Utility District Preliminary Engineering Report
Prepared for Delta County MUD by Hayter Engineering, Inc., Paris, Texas, 2002

Deport Water Conservation and Drought Contingency Plan
Prepared for the City of Deport by Hayter Engineering, Inc., Paris, Texas, 2000

Detroit Preliminary Engineering Report
Prepared for the City of Detroit by Hayter Engineering, Inc., Paris, Texas, 2002

Franklin County Water District Water Conservation and Drought Contingency Plan
Prepared for the FCWD by Hayter Engineering, Inc., Paris, Texas, 2005

Gafford Chapel WSC Drought Contingency Plan
Prepared for the Gafford Chapel WSC by Hayter Engineering, Inc., Paris, Texas, 2000

Lamar County Water Supply District Drought Contingency Plan
Prepared for the LCWSD by Hayter Engineering, Inc., Paris, Texas, 1999

Pecan Gap Drought Contingency Plan
Prepared for the City of Pecan Gap by Hayter Engineering, Inc., Paris, Texas, 2004

Point Water Treatment Plan Expansion
Prepared for the City of Point by Hayter Engineering, Inc., Paris, Texas, 2001

Reno Water Supply Improvements
Prepared for the City of Reno by Hayter Engineering, Inc., Paris, Texas, 2003

Reno Water Conservation and Drought Contingency Plan
Prepared for the City of Reno by Hayter Engineering, Inc., Paris, Texas, 2004

Winnsboro Water Conservation and Drought Contingency Plan
Prepared for the City of Winnsboro by Hayter Engineering, Inc., Paris, Texas, 2005

Shady Grove WSC #2 Drought Contingency Plan
Prepared for the Shady Grove WSC by Hayter Engineering, Inc., Paris, Texas, 2002

Fouke WSC Preliminary Engineering Report
Prepared for Fouke WSC by NRS Consulting Engineers, Inc., 2002

Bi-County WSC Service Area No. 4 Preliminary Engineering Report
Prepared for Bi-County WSC by NRS Consulting Engineers, Inc., 2002

Harleton WSC Preliminary Engineering Report
Prepared for Harleton WSC by NRS Consulting Engineers, Inc., 2000

Lake Fork WSC Preliminary Engineering Report
Prepared for Lake Fork WSC by NRS Consulting Engineers, Inc., 2004

The Economic Impact of the Proposed Marvin Nichols I Reservoir to the Northeast Texas Forest Industry
Prepared for the Texas Forest Service The Texas A&M University System Weihuan Xu, Ph.D. Publication 162, August 2002.

The Economic, Fiscal, and Developmental Impacts of the Proposes Marvin Nichols Reservoir Project
Prepared for the Sulphur River Basin Authority by Bernard L. Weinstein, Ph.D., Terry L. Clower, Ph.D. March 2003.

RED RIVER AUTHORITY REPORTS

An Assessment of the Biological Integrity of the Eastern Red River Basin in Texas.

Prepared by the Red River Authority, Wichita Falls, Texas, April, 1998.

This paper gives insight to the biological health of streams located in the eastern Red River Basin in Texas. Results show good overall biological health of the selected streams in the region with some moderate impairment.

Red River Basin Chloride Control Project.

Prepared by the Red River Authority of Texas, Wichita Fall, Texas, January 1997.

This report discusses the goals of the chloride control project and summarizes the environmental issues involved.

Regional Assessment of Water Quality, Red River Basin of Texas: Biennial Report.

Prepared by Red River Authority of Texas, 1994.

Regional Assessment of Water Quality, Red River Basin of Texas.

Prepared by the Red River Authority of Texas and HDR Engineering, Inc. in cooperation with the Texas Water Commission, 1992.

Plan Summary Report for the Red River Study Area Water Quality Management Plan.

Prepared by the Red River Authority for the Texas Department of Water Resources, 1981.

SABINE RIVER AUTHORITY REPORTS

Yield Study, Toledo Bend Reservoir.
Prepared for SRA Texas and Louisiana by Brown & Root, July, 1991.

Trans-Texas Water Program Southeast Area Phase I Report.
Prepared by Brown & Root in association with Freese & Nichols, Inc., March 1994.

Trans-Texas Water Program Planning Information Update.
Prepared by Brown & Root in association with Freese & Nichols, Inc., April, 1996.

Update of the Master Plan for the Sabine River and Tributaries in Texas.
Prepared for SRA Texas by Espey, Hutson, & Associates and Tudor Engineering Company, March,1985.

Lake Fork Reservoir Yield Determination.
Prepared for SRA Texas by Espey, Hutson, & Associates, April, 1985.

Lake Tawakoni Yield Determination.
Prepared for SRA Texas by Espey, Hutson, & Associates, April, 1985.

Update of Master Plan for the Sabine River and Tributaries in Texas, Hydrology Appendix.
Prepared for SRA Texas by Espey, Hutson, & Associates, 1985.

Upper Sabine Basin Regional Water Supply Plan.
Prepared for SRA Texas by Freese & Nichols, 1988.

Reconnaissance Study for the Lake Tawakonoi Regional Water Supply System.
Prepared for SRA Texas by Freese & Nichols, November, 1989.

Master Plan of the Sabine River and Tributaries in Texas.
Prepared by Forrest & Cotton, January, 1955.

Supplement to the Master Plan of the Sabine River and Tributaries in Texas.
Prepared by Forrest & Cotton, November, 1962.

Report on Lake Tawakoni Yield Study.
Prepared for SRA Texas by Forrest & Cotton, March, 1977.

Report on Potential Water Supply From Sabine River Basin.
Prepared for North Texas Municipal Water District by Forrest & Cotton, August, 1979.

Water Supply Study, Addendum No. 1.
Prepared for the City of Marshall, Texas by Kindle, Stone, & Associates, Inc., January, 1981.

Longview Water Supply Study.

Prepared for the City of Longview, Texas by Kindle, Stone, & Associates, Inc., May, 1982.

Preliminary Feasibility Study, Little Cypress Reservoir.

Prepared for the Cities of Shreveport, Longview, Marshall, Kilgore, Gilmore, and Hallsville by Kindle, Stone, & Associates, Inc., July, 1982.

Big Sandy Reservoir Study.

Prepared for the SRA Texas by Kindle, Stone, & Associates, Inc., October, 1984.

Preplanning Studies for the Upper Sabine Reservoir Projects (Mineola, Lake Fork, and Big Sandy).

Prepared by Sabine River Authority of Texas, July 1, 1972.

1996 Regional Assessment of Water Quality – Sabine River Basin, Texas, Vol. I-III.

Prepared by Sabine River Authority of Texas, October, 1992.

1992 Regional Assessment of Water Quality-Sabine River Basin, Texas.

Prepared by Sabine River Authority of Texas, October, 1996.

Upper Sabine Water Supply Study.

Prepared for the SRA Texas, and twelve cities and four private entities interested in obtaining water from the upper Sabine River watershed by URS Engineers, May, 1983.

Report on Comprehensive Basin Study: Sabine River and Tributaries, Texas and Louisiana.

Prepared by U.S. Army, Corps of Engineers, Fort Worth District, February, 1981.

Sabine River and Tributaries, Texas and Louisiana.

Prepared by U.S. Army Corps or Engineers, Fort Worth District, February, 1981.

Problems Relating to the Proposed Waters Bluff Reservoir and other Surface Water Supply Projects in Texas in Texas, Sabine River Authority.

Prepared by the Sabine River Authority, Orange, Texas, December, 1996.

This report discusses issues related to the proposed Waters Bluff Reservoir in Wood, Upshur, and Smith counties as well other surface water projects in Texas.

Comprehensive Sabine Watershed Management Plan – Draft.

Prepared for the Sabine River Authority by Freese and Nichols, Inc., Forth Worth, Texas, April, 1999.

This report presents the 50-year regional water management plan for the Sabine River Basin. Included in this report are descriptions of current population, water use, and water supply estimates for the Sabine basin, as well as potential sources for additional supply.

Feasibility Study for the Lake Tawakoni Regional Water Supply System.

Prepared by Freese and Nichols, Inc. for the Sabine River Authority of Texas in conjunction with the Texas Water Development Board, 1991.

Feasibility Study for the Lake Tawakoni Regional Water Supply System.
Prepared by Freese and Nichols, Inc., 1991.

Preliminary Feasibility Study: Interbasin Water Transfer from the Sabine River to the San Jacinto River Authority Service Area.
Prepared by Ronnie M. Lemmons and John Lee Rutledge, Freese and Nichols, Inc., 1989.

Feasibility Study Interbasin Transfer, Sabine to San Jacinto.
Prepared by Wayne Smith & Associates, 1988.

Problems Relating to the Proposed Waters Bluff Reservoir and the Texas Water Plan.
Prepared by the Sabine River Authority of Texas, 1987.

Preliminary Feasibility Study: Waters Bluff Dam and Reservoir, Sabine River, Texas.
Prepared by Espey Huston and Associates, 1986.

Water Quality Management Program Data Summary and Evaluation Report January, December, 1976.
Prepared by the Sabine River Authority of Texas for Lake Fork Creek, 1977.

Water Quality Management Program Data Summary and Evaluation Report January, 1975 – December, 1979.
Prepared by the Sabine River Authority of Texas, Technical Division for Lake Fork, 1977.

Plan Summary Report for the Sabine Basin Water Quality Management Plan.
Prepared by the Sabine River Authority of Texas for the Texas Department of Water Resources, 1981.

Water Quality Study.
Prepared by Forrest and Cotton, Inc. for the Sabine River Authority of Texas, 1966.

Master Plan of the Sabine River and Tributaries in Texas: Report on Supplement.
Prepared by Forrest and Cotton, Inc., 1962.

Proposed Toledo Bend Dam on the Sabine River of Texas and Louisiana: Preliminary Report.
Prepared by Forrest and Cotton, Inc., 1955.

Master Plan of the Sabine River and Tributaries in Texas.
Prepared by Forrest and Cotton, Inc., 1955.

Pertinent Data for Reservoirs Required by 1980.
Prepared by the Sabine River Authority of Texas.

Regional Assessment of Water Quality.
Prepared by the Sabine River Authority of Texas.

Comprehensive Sabine Watershed Management Plan

Prepared for the Sabine River Authority of Texas in Conjunction with the Texas Water Development Board by Freese and Nichols, Inc. in association with Brown and Root, Inc. and LBG-Guyton Associates, December, 1999

Upper Sabine Basin Water Supply Study

Prepared by Kellogg Brown & Root, Inc., March 2003.

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION REPORTS

Texas Clean Rivers Long Term Action Plan.

Prepared by the Texas Natural Resource Conservation Commission, 1991.

Provides a brief overview of the Clean Rivers Program strategies of the program statewide.

The Statewide Watershed Management Approach for Texas.

Prepared by the Texas Natural Resource Conservation Commission, March, 1997.

Provides background information and guidance for integrating and coordinating key program functions through a watershed management approach.

Clean Water for Texas – Solving Water Quality Problems.

Prepared by the Texas Natural Resource Conservation Commission, August, 1997.

Discusses water quality impairments, their causes, and strategies for addressing impairments. Explanation of the watershed management approach..

Aquatic Life Use and Dissolved Oxygen Concentrations During Low-Flow, High-Stress Summer Conditions, 1995-1996.

Prepared by the Texas Natural Resource Conservation Commission, February, 1998.

Summary of a study designed to provide information on actual life use and dissolved oxygen concentrations in different sized streams in the Cypress Creek Basin.

A Survey of Mercury Concentrations in the Cypress Creek and Super Sabine River Basins of Northeast Texas.

Prepared by the Texas Natural Resource Conservation Commission, December, 1996.

Discusses mercury and its properties, lists mercury concentrations in northeast Texas waters, and describes the process of the study and its results.

A Public Water Supply Protection Strategy.

Prepared by Brad L. Cross, David P. Terry, and Valerie Billings and the Texas Water Commission for the City of Atlanta, 1990.

A Public Water Supply Protection Strategy.

Prepared by Brad L. Cross, geologist; David P. Terry, environmental scientist; David M. Prescott, engineering specialist for the Gum Springs Water Supply Corporation, 1994.

A Public Water Supply Protection Strategy.

Prepared by Brad L. Cross, geologist; David P. Terry, hydorlogist; Mabel Lin, Engineering assistant for the Liberty City Water Supply corporation, 1994.

Water Quality Management Plan.

Prepared by the Texas Water Quality Board for the Red Basin, 1975.

A Public Water Supply Protection Strategy.

Prepared by John Jasek for the Lake Fork Water Supply Corporation, 1998.

A Public Water Supply Protection Strategy.

Prepared by John Jasek for the Foulke Water Supply Corporation, 1998.

A Public Water Supply Protection Strategy.

Prepared by Brad L. Cross, geologist; David P. Terry, environmental scientist; David M. Prescott, engineering specialist for the New Hope Water Supply Corporation, 1994.

Interim Water Quality Plan for Como Texas in Hopkins County in Sabine River Basin.

Prepared by Texas Water Quality Board, 1971.

Water Quality Management Plan.

Prepared by the Texas Water Quality Board for the Red Basin, 1975.

Summary Report: Regional Assessments of Water Quality Pursuant to the Texas Clean Rivers Act (Senate Bill 818).

Prepared by the Texas Water Commission in partnership with Red River Authority of Texas, 1992.

Excerpted Statewide Materials: Summary Report: Regional Assessments of Water Quality Pursuant to the Texas Clean Rivers Act (Senate Bill 818).

Prepared by the Texas Water Commission in partnership with Red River Authority of Texas, 1992.

Regional Assessment of Water Quality, Cypress Basin of Texas: Regional Assessment Report September 1, 1993 through August 31, 1994.

Prepared by HDR Engineering in association with Paul Price Associats, Inc. prepared in cooperation with the Texas Natural Resource Conservation Commission under the authorization of the Clean Rivers Act for the Titus County Fresh Water Supply district No. 1, 1994.

TEXAS WATER DEVELOPMENT BOARD REPORTS

Aquifers of Texas.

Prepared by Texas Water Development Board, November, 1995.

This report discusses major and minor aquifers in Texas. Discussion includes a description of the aquifer, its water quality, and changes in the aquifer over time.

Volumetric Survey of Lake Cypress Springs.

Prepared by the Franklin County Water District by the Texas Water Development Board, July 30, 1998.

This report summarizes a hydro graphic survey of Lake Cypress Springs. The purpose of the survey was to determine the capacity of the lake at the conservation pool level. Survey results are presented.

Memorandum Report – Updated Water Project Opinion of Cost.

Prepared for the Texas Water Development Board by Freese and Nichols, Inc., Fort Worth, Texas, June 3, 1996.

This report presents estimated costs to develop numerous water supply and water transmission projects across the state.

Ground-Water Resources of the Nacatoch Aquifer.

Prepared for the Texas Water Development Board by John B. Ashworth, April,1988.

This report presents information of the Nacatoch Aquifer which occurs in a narrow band in northeast Texas. Region D Counties include Hunt, Hopkins, Franklin, Titus, Red River, Rains and Bowie Counties. Records of wells and location maps are presented as well as a general discussion of the aquifer itself.

Occurrence, Availability, and Chemical Quality of Ground Water in the Blossom Sand Aquifer.

Prepared for the Texas Water Development Board by Celeste McLaurin, August, 1988.

Study of groundwater in the Blossom Sand. Discusses geographic setting, geology as related to groundwater, the occurrence of groundwater, utilization and development of the Blossom Sand, and availability of water in the aquifer.

Ground-Water Resources of Camp, Franklin, Morris, and Titus Counties, Texas.

Prepared for the Texas Water Development Board by M.E. Broom, W.H. Alexander, Jr., B. N. Myers, July, 1965.

A description of the economic development and water use and a summary of the groundwater resources in Camp Franklin, Morris and Titus Counties.

Water-Level and Water-Quality from Observation Wells in Northeast Texas.

Prepared for the Texas Water Development Board by Howard D. Taylor, February, 1976.

Presents quantitative and qualitative information on groundwater resources in 20 northeast Texas counties, including Hunt, Lamar, Red River and Delta Counties of Region D. Location maps and records of selected wells are included. Region D aquifers include the Woodbine, Nacatoch and Blossom Sand.

Occurrence, Availability, and Chemical Quality of Ground Water in the Cretaceous Aquifers of North-Central Texas.

Prepared for the Texas Water Development Board by Phillip L. Nordstrom, April, 1982.

Evaluation of Water Resources in Part of North-Central Texas.

Prepared for the Texas Water Development Board, by Bernard Baker, Gail Duffin, Robert Flores, Tad Lynch, January, 1990.

This study presents a discussion of the groundwater resources in 23 counties of north central Texas. Surface water supplies are discussed. Population projections and supply/demand evaluation through year 2010. Counties in Region D including Hunt, Delta, Lamar, and Red River. Region D aquifers included are the Woodbine, Nacatoch and Blossom Sand.

Investigation of Alleged Ground-Water Contamination new Kilgore, Gregg County, Texas.

Prepared for the Texas Water Development Board, by H. D. Holloway, April, 1964.

Water Resources of Gregg County, Texas.

Prepared for the Texas Water Development Board by W. L. Broadhurst, September, 1945.

Base-Flow Studies, Little Cypress Creek, Upshur, Gregg, and Harrison Counties, Texas, Quantity and Quality, January and June, 1964.

Prepared for the Texas Water Development Board by J. T. Smith, J. H. Montgomery, J. F. Blakey, August, 1966.

This report discusses the base-flow investigation of Little Cypress Creek, made by the U.S. Geological Survey. It begins by describing the watershed features, then the geohydrology character of the streamflow and, water uses in the creek, and concludes by comparing the two studies.

Ground-Water Resources of Gregg and Upshur Counties, Texas.

Prepared for the Texas Water Development Board by M. E. Broom, October, 1969.

Discusses groundwater resources in Gregg and Upshur Counties, including the Carrizo-Wilcox and Queen City aquifers. Concludes that substantially increased supplies above 1996 pumpage levels are available – however, high chloride levels in parts of Upshur and Gregg may be a problem in the Carrizo-Wilcox, and iron content may impede development of the Queen City. Contains location maps and records of selected wells.

Evaluation of Ground-Water Resources in the Vicinity of Henderson, Jacksonville, Kilgore, Lufkin, Nacogdoches, Rusk, and Tyler in East Texas.

Prepared for the Texas Water Development Board by Richard D. Preston, Stephen W. Moore, February, 1991.

Presents a discussion of a study to identify and evaluate present and potential groundwater problems within Angelina, Cherokee, Gregg, Nacadoches, Rusk and Smith Counties. Includes research on geohydrology, climate, geographic setting, groundwater problems, projected water demands and the availability of ground and surface water in the study area.

Water Resources of Harrison County, Texas.

Prepared for the Texas Water Development Board by W. L. Broadhurst, September, 1943.

Ground-Water Resources of Harrison County, Texas.

Prepared for the Texas Water Development Board by M. E. Broom, B. N. Myers, August, 1966.

Discusses the quantity, quality and availability of groundwater in Harrison county. It also speculates the availability of groundwater for future development. Includes the Wilcox Group, the Carrizo Sand, The Reklaw formation and the Queen City Sand.

Ground Water in the Greenville Area, Hunt County, Texas.

Prepared for the Texas Water Development Board by N. A. Rose, June, 1945.

Water Resources of Marion County, Texas.

Prepared for the Texas Water Development Board by W. L. Broadhurst.

Ground-Water Resources of Rains and Van Zandt Counties, Texas.

Prepared for the Texas Water Development Board by D. E. White, April, 1973.

Study of quantity, quality and availability of groundwater in Rains and Van Zandt Counties. Includes the Carrizo-Wilcox present in both counties, and the Queen City Sand, present in Van Zandt County.

Availability and Quality of Ground Water in Smith County, Texas.

Prepared for the Texas Water Development Board by J. W. Dillard, May, 1963.

A description of the groundwater resources of Smith County, including the Carrizo-Wilcox, Queen City and Sparta aquifers. Location maps and records of selected wells are included.

Results of Pumping Test of Municipal Wells at Tyler, Texas.

Prepared for the Texas Water Development Board by W. L. Broadhurst, October, 1944.

City of Hawkins, Wood County, Texas.

Prepared for the Texas Water Development Board by S. C. Burnitt, March, 1963.

Ground-Water Resources of Wood County, Texas.

Prepared for the Texas Water Development Board by M. E. Broom, August, 1968.

Study of the geology in Wood County, focusing on water bearing formations including the Wilcox Group, the Carrizo Sand, the Queen City Sand and the Sparta Sand. The report also addresses the chemical quality and availability of groundwater for future development in each formation. Records of wells and springs in Wood County are included.

Ground-Water Resources of Cass and Marrion Counties, Texas Report 135.

Prepared by the Texas Water Development Board, October, 1971.

A discussion of the groundwater resources of Cass and Marion Counties in Region D. Aquifers include the "Cypress aquifer", which is composed of the Wilcox Group, Carrizo Sand, Reklaw formation and the Queen City Sand. Concludes that substantially increased *quantities of water can be withdrawn with proper well development. Location maps and records of selected wells are included.*

Suspended-Sediment Load of Texas Streams Compilation Report 1975-1982 Report 306.

Prepared by the Texas Water Development Board, July 1998.

Presents the results of suspended-sediment load measurements at permanent observation points from 1975 thought 1982, and references earlier publications for pre-1975 data.

Groundwater Conditions in Texas, 1980-1985, Report 309.

Prepared by the Texas Water Development Board, October 1988.

A summary description of characteristics, pumpage, and water levels in the various aquifers of Texas including the Woodbine, Carrizo-Wilcox, Queen City, Sparta, Nacatoch and Blossom Sand in Region D.

Water Quality Records for Selected Reservoirs in Texas – 1976-77 Water Years Report 271.

Prepared by the Texas Department of Water Resources, September 1982.

Tabulates results of water quality surveys in certain Texas reservoirs, including Wright Patman Lake and Lake O' the Pines in Region D, and references sources for earlier similar data.

Ground-Water Publication Abstracts, 1991.

Edited by Janie Payne, Geologist for the Texas Water Development Board, March 1992.

Includes the abstracts of various groundwater investigations conducted by the TWDB during 1991. Included reports were prepared by Ground Water Section geologists primarily from data collected by staff technicians.

Erosion and Sedimentation by Water in Texas.

Prepared for the Texas Water Development Board by John H. Greiner, Jr., Geologist U.S. Soil Conservation Service.

Presents the results of a study conducted by the Soil Conservation Service, Forest Service, and Economic Research Service – U.S. Department of Agriculture, concerning the average annual rates of soil erosion and sedimentation within the State of Texas. Provides estimates of the amounts of grass sheet and rill erosion and gully and streambank erosion occurring on an average annual basis above 300 yield points.

An Analysis of Bottomland Hardwood Areas at Three Proposed Reservoir Sites in Northeast Texas.

Prepared by the Texas Water Development Board, 1997.

Water Requirements in Texas and Proposed Projects in Lower Red River Basin, Sulphur River Basin and Cypress Creek.

Prepared by the Texas Water Development Board, 1967.

Texas Water Development Board Study on Effectiveness of Various Water Conservation Techniques

Prepared for Texas Water Development Board by GDS Associates, Inc., 2001

U. S. ENVIRONMENTAL PROTECTION AGENCY

Report on Caddo Lake, Caddo Parish, Louisiana Marion and Harrison County, Texas.
Prepared by the U.S. Environmental Protection Agency, 1977.

Report on Lake Tawakoni, Hunt, Rain, and Van Zandt Counties, Texas.
Prepared by the U.S. Environmental Protection Agency, 1977.

Report on Wright Patman (Texarkana) Reservoir, Bowie and Cass Counties, Texas.
Prepared by the U.S. Environmental Protection Agency, 1977.

Proposed Radon in Drinking Water Rule.
Prepared by the U.S. Environmental Protection Agency, Update April 2000.

Long Term 2 Enhanced Surface Water Treatment Rule.
Prepared by the U.S. Environmental Protection Agency, Proposed November 2007.

Long Term 1 Enhanced Surface Water Treatment Rule.
Prepared by the U.S. Environmental Protection Agency, January 2002.

Consumer Confidence Report Rule.
Prepared by the U.S. Environmental Protection Agency, August 1998.

Lead and Copper Rule.
Prepared by the U.S. Environmental Protection Agency, June 1991.

Total Coliform Rule.
Prepared by the U.S. Environmental Protection Agency, June 1989.

Stage 1 Disinfectants and Disinfection Byproducts Rule.
Prepared by the U.S. Environmental Protection Agency, December 1998.

Interim Enhanced Surface Water Treatment Rule.
Prepared by the U.S. Environmental Protection Agency, December 1998.

Filter Backwash Recycling Rule.
Prepared by the U.S. Environmental Protection Agency, June 2001.

The Public Notification Rule.
Prepared by the U.S. Environmental Protection Agency, May 2000.

Arsenic and Clarification to Compliance and New Source Monitoring Rule.
Prepared by the U.S. Environmental Protection Agency, January 2001.

Radionuclides Rule.
Prepared by the U.S. Environmental Protection Agency, December 2000.

Proposed Stage 2 Disinfectants and Disinfection Byproducts Rule.

Prepared by the U.S. Environmental Protection Agency, Proposed November 2007.

Surface Water Treatment Rule.
Prepared by the U.S. Environmental Protection Agency, June 1989.

Phase I Rule.
Prepared by the U.S. Environmental Protection Agency, July 1987.

Phase II Rule.
Prepared by the U.S. Environmental Protection Agency, January 1991.

Phase IIB Rule.
Prepared by the U.S. Environmental Protection Agency, July 1991.

Phase V Rule.
Prepared by the U.S. Environmental Protection Agency, July 1992.

Ground Water Rule.
Prepared by the U.S. Environmental Protection Agency, May 2000.

USGS REPORTS

Ground Water in the Greenville Area, Hunt County, Texas.
Prepared by Nicholas Anthony Rose in cooperation between the Geological Survey, U.S. Department of the Interior, and the Texas State Board of Water Engineering, 1963.

Surface Water Supplies in Gregg County, Texas.
Prepared by the U.S. Geological Survey. Water Resources Division (Tex.), 1943.

Water Supply near Woodall, in southwestern Corner of Harrison County, Texas.
Prepared by the U.S. Geological Survey. Water Resources Division (Tex.), 1942.

Harrison County, Texas Water Resources.
Prepared by W.L. Broadhurst and S.D. Breeding for the Texas Board of Water Engineers, 1943.

Surface Water of Harrison County, Texas.
Prepared by the U.S. Geological Survey. Water Resources Division (Tex.), 1943.

Ground Water Resources of Harrison County, Texas.
Prepared by M.E. Broom and B.N. Myers and the U.S. Geological Survey in cooperation with the Texas Water Development Board and the Harrison county Commissioners Court, 1966.

Surface Water Supply of Marion County, Texas.
Prepared by the U.S. Geological Survey. Water Resources Division (Tex.), 1943.

Surface Water Supply of Cass County, Texas.
Prepared by the U.S. Geological Survey. Water Resources Division (Tex.), 1943.

Surface WaterSupply of Camp, Franklin, and Titus Counties, Texas.
Prepared by the U.S. Geological Survey. Water Resources Division (Tex.), 1945.

Surface Water Supply of Rains County, Texas.
Prepared by the U.S. Geological Survey. Water Resources Division (Tex.), 1943.

Surface Water Supply of Hopkins county, Texas.
Prepared by the U.S. Geological Survey. Water Resources Division (Tex.), 1943.

CORPS OF ENGINEERS REPORTS

Caddo Lake Enlargement, Louisiana and Texas: Summary of Results.
Prepared by U.S. Corps of Engineers, 1985.

Survey Report on Sanders, Big Pine and Collier Creeks, Texas.
Prepared by U.S. Corps of Engineers, 1961.

OTHER REPORTS

Study of Potential Sources of Additional Surface Water Supply in the Red River Basin and the Cypress Creek Basin.
Prepared by Freese and Nichols, 1979.

Water Supply and Water Quality Control Study, Pat Mayse Reservoir, Sanders Creek, Texas: Study of Needs and Value of Storage for Municipal and Industrial Water Supply and Water Quality Control.
Prepared by U.S. Public Health Service, 1965.

An Ecological Assessment of Big Cypress Creek, Lake O' Pines, and Ellison Creek Reservoir, Lone Star, Texas.
Prepared by Glenn C. Millner and Alan C. Nye, 1990.

Water Storage Reservoir near Longview, Texas.
Prepared by Freese and Nichols for Tennessee Eastman Corporation, Texas Division Longview, Texas, 1950.

Comprehensive Development Plan: Waterworks, Sanitary Sewerage, Drainage.
Prepared by Henningson, Durham and Richardson, Inc., for Ark-Tex Council of Governments, 1970.

Water Quality Management Plan.
Prepared by the Texas Water Quality Board for the Red Basin, 1975.

Work Plan for Watershed Protection, Flood Prevention and Nonagricultural Water Management, Landford Creek Watershed, Red River County, Texas.
Prepared by Red River County Soil Conservation District with assistance by U.S. Department of Agriculture, Soil Conservation Service, 1958.

Work Plan for Watershed Protection, Flood Prevention, and Agricultural Water Management: Logan-Slough Creek Watershed, Lamar County, Texas.
Prepared by the U.S. Soil Conservation Service, 1963.

SUPPLEMENTAL TASK A.1
TREATMENT OF GROUNDWATER SUPPLIES

A supplemental task funded for this round of planning included an assessment of needs and the feasibility of additional treatment of groundwater to meet state and federal drinking water standards.

A1.1 Identification of Regional Groundwater Quality Problems

Methodology

To assess the need for additional treatment of groundwater, a study began with identification of regional groundwater quality problems. The TWDB well database was used to complete a detailed water quality assessment of the major and minor aquifers in Region D. TWDB standard water quality constituent analytical results from wells within the region were compared to primary and secondary drinking water maximum contaminant level (MCL) when the database contained sufficient data. In the case of fluoride, the lower secondary MCL of 2 mg/L was used for comparison purposes. The standard water quality constituents studied were: sulfate, chloride, pH, TDS, nitrate fluoride, iron and manganese.

TWDB infrequent water quality constituent analytical results were also compared to primary drinking water MCLs. Only constituents with primary drinking water MCLs and representative data records were selected for this effort. Only the most recent data for each well was used. The infrequent water quality constituents studied were: gross alpha, arsenic, barium, cadmium, chromium, copper, lead, and selenium. Organic and other regulated infrequent constituent data was very sparse and was not considered to be representative.

In addition to the water quality assessment, a phone survey was conducted to confirm existing conditions. Forty two entities were surveyed across the region. The majority of entities using groundwater have reported no major problems in water quality. Four of the entities reported high iron concentrations and five reported THM problems. Other problems include hydrogen sulfide, chloride, manganese and pH, although these are limited to a few entities. Refer to Table 1 for the summary of results.

Major Aquifers

Carrizo-Wilcox

The most recent water quality results available for individual wells in the Carrizo-Wilcox in Region D are summarized in Table 2 and in Figures A1.1 through A1.16. None of the available arsenic results were above detection limits in the Carrizo-Wilcox in Region D. Two results exceeded the 5 µg/L primary MCL for cadmium, two samples exceeded the 15 µg/L primary MCL for lead, and one sample exceeded the 50 µg/L primary MCL for selenium. These represent about 1% or less of the total results in each case. One shallow well in the Wilcox in Hopkins County exceeded the MCL for each of these three constituents. This well accounts for most of the results that exceeded the MCL in the Carrizo-Wilcox in Region D. Cadmium, lead, and selenium were not detected in most samples. Of these non-detect results, thirty-nine cadmium results and 60 lead results had detection limits above the current MCL. These results were not included in this evaluation.

Only one fluoride result exceeded the 2 mg/L secondary MCL for fluoride. The average of the fluoride results is 0.3 mg/L, and the median result is 0.2 mg/L. No barium, chromium, copper, or gross alpha results exceeded their respective MCLs in the Carrizo-Wilcox in Region D. Alpha particles were generally not detected in the samples considered. Seven out of 615 nitrate results (1.1%) exceeded the 10 mg/L (as N) primary MCL. The results that exceeded the MCL were from samples in shallow outcrop wells. Four of these seven results were from wells in the area of western Wood County and eastern Rains County, although there were also many wells in that area that had nitrate concentrations well below the primary MCL. The average of all of the nitrate results is 1 mg/L. Sixteen percent of iron results exceeded the 300 µg/L secondary MCL, and about 11% of manganese results exceeded the 50 µg/L secondary MCL in the Carrizo-Wilcox in Region D. The outcrop wells had a greater percentage of results exceeding the secondary MCL for iron and manganese than wells downdip.

Less than 2% of total dissolved solids, chloride, and sulfate results exceeded the respective secondary MCLs of 1,000 mg/L, 300 mg/L, and 300 mg/L for these constituents. TDS results tended to be higher in Gregg, Marion, and western Harrison Counties, although no results from these counties exceeded the 1,000 mg/L secondary MCL. The average of all TDS results is 373 mg/L, and the median is 303 mg/L. About 27% of pH results were outside of the 6.5 - 8.5 secondary MCL range. About one third of these were below the 6.5 lower pH limit, and two thirds were above the 8.5 upper pH limit. The lower pH results tended to be from outcrop areas, while the higher pH results tended to be from downdip areas. The average of all pH results is 7.8, and the median is 8.0.

Trinity

There are relatively few water quality results available for individual wells in the Trinity in Region D. The results available are summarized in Table 3. Nearly half of the fluoride results exceeded the 2 mg/L secondary MCL, and about 12% exceeded the 4 mg/L primary MCL. The wells in the updip portions of the aquifer in northern Red River County produced samples below the secondary MCL, while wells in downdip areas in central Red River and Lamar Counties were exceeded the secondary MCL.

The median fluoride concentration in the Trinity in Region D was 1.5 mg/L, and the average concentration was 2.1 mg/L. No arsenic, barium, cadmium, chromium, copper, lead, nitrate, selenium, or gross alpha results exceeded their respective MCLs in the Trinity in Region D. Three iron results exceeded 300 µg/L secondary MCL in the Trinity in Region D, and these skew the 1,254 µg/L average upward. Over half of the iron results were less than 50 µg/L. Three manganese results exceeded the 50 µg/L secondary MCL. The iron and manganese results that exceeded their respective secondary MCLs were almost all from a cluster of wells in northwestern Red River County near the Red River.

Over half of total dissolved solids results exceeded the 1,000 mg/L secondary MCL. The average of the TDS results is 1,282 mg/L, and the median is 1,090 mg/L. The results from deeper downdip wells generally exceeded the MCL, while the results from shallower wells in northwestern Red River County were typically below the MCL. One quarter of chloride results and no sulfate results exceeded the 300 mg/L secondary MCL for each of these two constituents.

Minor Aquifers

Queen City-Sparta

The most recent water quality results available for individual wells in the Queen City-Sparta in Region D are summarized in Table 4 and in Figures A1.17 through A1.32. Five percent of nitrate results exceeded the 10 mg/L (as N) primary MCL in the Queen City-Sparta in Region D. A disproportionate number of these were from shallow wells in northeastern Wood County. The average of all nitrate concentrations for the Queen City-Sparta in Region D is 2 mg/L.

Six percent of lead results (3 of 50) exceeded the 15 µg/L primary MCL in the Queen City-Sparta in Region D. Two of these were from Queen City wells in Cass County, and a third was from a Queen City well in Smith County. About 60% of lead results were below detection limits, which ranged from 1 to 5 µg/L. The average of the lead results lead result is 4 µg/L, and the median is 2.49 µg/L. One copper result exceeded the 1,000 µg/L secondary MCL, and no copper results exceeded the 1,300 µg/L primary MCL. The average of all copper results is 52 µg/L, and the median is 7.8 µg/L, indicating that the average is skewed upward by a relatively small number of high values. No arsenic, barium, cadmium, chromium, selenium, fluoride, or gross alpha results exceeded their respective primary MCLs in the Queen City-Sparta in Region D. Very few arsenic, cadmium, chromium, and alpha particles concentrations were reported above detection limits. About 22% of iron results were reported above the 300 µg/L secondary MCL, and about 14% of manganese results exceeded the 50 µg/L secondary MCL. These results exceeding the secondary MCL for iron and manganese were well distributed throughout the Queen City in Region D.

Only one TDS result and two chloride results exceeded the secondary MCLs (300 mg/L and 1,000 mg/L, respectively) for these constituents. No sulfate results exceeded the 300 mg/L secondary MCL. The samples collected from wells in the Queen City-Sparta in Region D tended to have a very low pH, with over half below the lower secondary MCL of 6.5 and only one result above the upper MCL of 8.5. The low-pH results were well distributed throughout the Queen City-Sparta in Region D.

Blossom

The most recent water quality results available for individual wells in the Blossom in Region D are summarized in Table 5 and in Figures A1.33 through A1.49. Thirteen percent of fluoride samples from wells completed in the Blossom exceeded the 2 mg/L secondary MCL, but none of these exceeded the 4 mg/L primary MCL. Fluoride concentrations tend to be higher in downdip wells in the Blossom. One arsenic sample, near the City of Blossom in Lamar County, exceeded the 10 µg/L primary MCL. Only one nitrate result (from an outcrop well) exceeded the 10 mg/L (as N) primary MCL. No barium, cadmium, chromium, copper, lead, selenium, or gross alpha results exceeded their respective MCLs in the Blossom.

Iron content is extremely high in most samples from wells in Lamar County, often exceeding the 300 µg/L secondary MCL by a wide margin. Iron content in the Blossom in Red River County is much lower by comparison, although some groundwater samples have exceeded the MCL. The average iron concentration of the Blossom iron results is 13,113 µg/L, but the median is 187 µg/L, indicating that the average is skewed upward by the high values in Lamar County. Only one manganese result from the Blossom exceeded the 50 µg/L MCL.

About 38% of total dissolved solids results from the Blossom exceeded the 1,000 mg/L secondary MCL. Most of these were from samples collected from downdip wells. About 10% of all results exceeded 3,000 mg/L TDS. Comparatively fewer chloride and sulfate results (18% for each) exceeded the 300 mg/L secondary MCL for these two constituents. As with TDS, these concentrations generally tended to increase in downdip wells, although several sulfate samples from outcrop wells exceeded the MCL.

Nacatoch

Water quality results available for individual wells in the Blossom in Region D are summarized in Table 6 and in Figures A1.34 through A1.51. Almost one-quarter of fluoride results exceeded the 2 mg/L secondary MCL, and about 7% exceeded the 4 mg/L primary MCL. All of the results that exceeded the MCL were in downdip wells, primarily in Bowie, Hopkins, and Hunt Counties. Only three nitrate results (about 2% of all results) exceeded the 10 mg/L (as N) primary MCL. All of these were from samples collected in outcrop wells in 1941 (two results) and 1961 (one result). These samples are the most recent available from these wells. No arsenic, barium, cadmium, chromium, copper, lead, selenium, or gross alpha results exceeded their respective MCLs in the Nacatoch.

Iron results are generally below the 300 µg/L secondary MCL in the Nacatoch with a median concentration of 51 µg/L, although several samples did exceed the MCL in localized instances. Only one manganese result exceeded the 50 µg/L secondary MCL.

About one-third of total dissolved solids results from the Nacatoch exceeded the 1,000 mg/L secondary MCL. Most of these were from samples collected from downdip wells. The Mexia-Talco fault system serves as a control on the movement and freshness of groundwater in the downdip portions of the Nacatoch (Ashworth, 1988), however most water wells sampled appear to be on the fresher side of the major fault blocks in this system. Only 1% of results had a TDS content greater than 3,000 mg/L. About one-quarter of chloride results exceeded the 300 mg/L secondary MCL. The chloride results tended to increase in downdip wells. Only about 7% of sulfate results exceeded the 300 mg/L secondary MCL, and almost all of these were from samples collected from outcrop wells. Samples collected from Nacatoch wells were generally very alkaline, with an average pH of 8.4. Almost half of the pH results exceeded the 8.5 secondary upper limit.

Woodbine

There are fewer water quality results available for individual wells in the Woodbine in Region D than in the Blossom and Nacatoch. The results available are summarized in Table 7 and in Figures A1.34 through A1.51. One-quarter of fluoride results exceeded the 2 mg/L secondary MCL, and about 8% (1 out of 12) exceeded the 4 mg/L primary MCL. The fluoride concentrations in the Woodbine tend to increase in downdip wells. All of the results exceeding the primary and secondary MCLs were in downdip wells in Hunt County, and the one result from a far-downdip well in Lamar County was significantly higher than the wells on or near the outcrop. No arsenic, barium, cadmium, chromium, copper, lead, nitrate, selenium, or gross alpha results exceeded their respective MCLs in the Woodbine in Region D.

Three iron results exceeded 300 µg/L secondary MCL in the Woodbine. Two of these were in Hunt County, and a third was in Lamar County. The median iron concentration is 100 µg/L, the average concentration of 370 µg/L is skewed upward due to the high result in Lamar County. No manganese results exceeded the 50 µg/L secondary MCL. Nearly half of the 12 total dissolved solids results in Woodbine wells exceeded the 1,000 mg/L secondary MCL. Three of these were downdip wells in Hunt County, and three other Hunt County wells were in the 800 - 900 mg/L range. The median TDS result in the Woodbine in Region D is 865 mg/L. Only one chloride result and two sulfate results exceeded the 300 mg/L secondary MCL for these two constituents in the Woodbine in Region D. The median chloride result was 139 mg/L, and the average was 156 mg/L. The median sulfate result was 162 mg/L and the average was 293 mg/L.

A1.2 General Treatment Techniques

Several treatment techniques are effective at removing various constituents from groundwater, and are described below.

Ion exchange is useful for the treatment of calcium, magnesium, barium, copper, lead, zinc, radium, ammonium, fluoride, nitrate, phosphate and many other substances. Ion exchange is the transfer of anions or cations from the untreated water to the solid phase of the resin. Untreated water is passed through a filter bed of a resin material, where the unwanted ions transfer to the resin. The resin material will vary depending on the constituent requiring removal. Ion exchange resins have a finite capacity. When used up, or exhausted, an unacceptable concentration of ions passes through to the effluent. The exhausted resin can be regenerated by backwashing with a solution which will displace and replace the unwanted ions. The wastewater, or brine, generated during ion exchange ranges from 3% to 10% of the water treated. Refer to Figure A1.50 for a flow schematic of the ion exchange process.

Membrane processes are useful for the treatment of suspended solids, turbidity, bacteria, viruses, pesticides, fluoride, nutrients, phosphorus, metals and hardness. In membrane processes, raw water enters a gravity or pressure tank containing membrane modules. The membranes are permeable to water, but not to the substance that will be removed. Types of pressure driven membrane systems include reverse osmosis, nanofiltration, ultrafiltration and microfiltration. Of these, reverse osmosis is the most common method of treatment in drinking water supply. In this process, the water moves from a more concentrated solution through a semi-permeable membrane into a less concentrated solution. The waste produced, called brine, is comprised of the constituents that do not pass through the membrane. The volume of brine depends on several factors, including feed rate and membrane type. Refer to Figure A1.51 for a flow schematic of the reverse osmosis process.

Coagulation is useful for treating calcium, magnesium, arsenic, color, heavy metals and other minerals. Coagulation is the process in which chemicals are added to water, causing contaminant particles to become attached to each other by the electrostatic charges. The particles become large and heavy enough to be removed by subsequent settling or filtration. Alum, or aluminum sulfate, is the most common coagulant used, although ferric sulfate and various longer chain polymers are also used. This process is followed with precipitation and filtration to remove the unwanted substance, and pH adjustment if necessary. Refer to Figure A1.52 for a flow schematic of the coagulation process.

Oxidation reactions can also provide water treatment processes and address a wide range of water quality problems. These may include iron, manganese, sulfur, color, tastes, odor and synthetic organics. Oxidation is a chemical reaction in which an additive oxidant causes the contaminant to lose an electron which charges the contaminant from a soluble to an insoluble state. The insoluble contaminant then precipitates out but is gained by another substance. This can be done through the addition of oxygen or with chemicals such as chlorine, chlorine dioxide, permanganate and ozone. Oxidation is generally followed with precipitation and filtration to remove the unwanted substance. Refer to Figure A1.53 for a flow schematic of the oxidation process.

Treatment Techniques for Specific Contaminants

<u>Iron and Manganese</u>

Iron is present in rocks and soils and when in groundwater, iron is in soluble form. Upon contact with air, the water will become cloudy and deposit a reddish brown precipitate which can stain porcelain fixtures and laundry. Manganese is also present in rocks and soils. It typically appears with iron in groundwater. The presence of manganese can cause black staining, bad taste and growth of microorganisms. Drinking water standards regulate iron levels to be under 0.3 mg/L and manganese levels to be under 0.05 mg/L. Iron levels in groundwater from this region have been measured as high as 13 mg/L while manganese levels have been measured as high as 0.1 mg/L.

Iron and manganese can be removed from groundwater using several treatments: coagulation and precipitation, oxidation and precipitation, membrane processes and sequestration. Oxidation and precipitation is the most common method for iron and manganese removal. Lower levels of iron can be oxidized through aeration and higher levels chemically by the addition of chlorine. Potassium permanganate is more commonly used for manganese because manganese is more difficult to oxidize than iron, and potassium permanganate is a stronger oxidant. Following precipitation, pressure filtration is generally used to remove the iron and manganese precipitate.

For the oxidation treatment process, the groundwater is pumped from the well and through a master meter. Potassium permanganate or chlorine is injected to oxidize the iron and manganese, with aeration. Approximately 1 mg/L of oxidant is needed per 1 mg/L of iron, while 2 mg/L of oxidant is needed per 1 mg/L of manganese. The potassium permanganate is injected with a liquid chemical feed system – the chlorine can be injected as a liquid or as a gas. After oxidizing, the water passes through a pressure sand filter to remove the iron and manganese. The filter is periodically backwashed and the waste is discharged to a settling pond or sanitary sewer. Depending on the concentration of iron and manganese needing removal, the equipment price will run from $75,000 to $178,500 uninstalled and $150,000 to $300,000 installed, for a 150 gpm well. Power, chemicals and similar operating costs will be around $0.20 per 1000 gal produced. The pressure filters need to be backwashed once a day. This treatment process will require 1 to 2 hours of an operator’s time per day to maintain equipment, and run the backwash cycle.

In oxidation, for each mg/L of iron or manganese in solution, 1.5 mg/L to 2 mg/L of sludge may be produced. The volume of supernate generally ranges from 1% to 5% of influent flow, based upon the iron concentration.

Care must be practiced when disposing the waste stream into the sanitary sewer system. Levels of iron ranging from 5 to 500 mg/L and manganese concentrations over 10 mg/L can inhibit the activated sludge process at the wastewater treatment plant.

Iron and manganese can also be controlled through "sequestration", which is a process that holds the contaminants in a soluble form through the addition of certain chemicals, typically liquid polyphosphates. The iron and manganese is not removed, rather it is prevented from forming turbidity or color for the detention time in the water system. Typically the polyphosphate additive is delivered in a 55 gallon drum and fed into the well discharge by a chemical metering pump. Generally, sequestration will not work for iron concentrations over 1.5 mg/L and manganese concentrations over 0.1 mg/L. A pilot study is needed to determine the specific water chemistry to effectively choose the type and dosage of phosphates needed. The chemicals will range from $9 to $12 per gal, while dosage rates will range from 3 to 10 gal per million gallons treated. For a 150 gpm well, the chemicals required for sequestration will cost about $0.03 to $0.12 per 1000 gal treated and the chemical metering pump will cost approximately $450. There is no waste stream to be disposed of.

Sulfate

Sulfate in groundwater comes from the oxidation of sulfite ores. High levels of sulfate can cause a bitter taste in the water and may cause a laxative effect. Drinking water standards limit sulfate levels to be under 250 mg/L. Sulfate levels in groundwater from this region have been reported up to 293 mg/L.

The most effective method of treatment is using reverse osmosis. The removal rates will range from 95% to 98%. Sulfate can also be removed by ion exchange with removal rates between 95% and 100%. This method is not preferred because the process will introduce chloride into the water through the exchange.

The groundwater is pumped by the well, passed through a master meter and into the reverse osmosis treatment equipment. The budget equipment price is $140,000 uninstalled, for a 150 gpm well. The operating cost is around $0.75 per 1000 gal produced. This includes operating and power costs and membrane replacements. About 1 to 2 hours per day is needed by a treatment plant operator for this process.

With reverse osmosis, about 25% of the influent water will be wasted to backwash. Assuming a well capacity of 150 gpm, around 37.5 gpm is wasted, and the contaminant concentration in the wastewater will be 4 to 5 times the influent concentration.

Fluoride

Fluoride occurs in a few types of rocks. Groundwater may experience fluoride contamination from certain insecticides and chemical wastes. High levels of fluoride may cause abdominal pain, dizziness and headache. Drinking water standards regulate fluoride levels to be under 2 mg/L because higher levels can cause staining of teeth. Fluoride levels in groundwater from this region have been reported up to 2.1 mg/L.

Fluoride can be removed from groundwater using reverse osmosis, although the most common method of removal is ion exchange. Fluoride is removed using the ion exchange process with activated alumina as the filter media and the filter media is regenerated with caustic soda, alum or sulfuric acid.

For reverse osmosis, the groundwater is pumped by the well, passed through a master meter and into the treatment equipment. The budget equipment price is $165,000 uninstalled. The operating cost is around $0.75 per 1000 gal produced. This includes operating and power costs and membrane replacements. About 1 to 2 hours per day is needed by a treatment plant operator for this process.

With reverse osmosis, about 25% of the feed water will be wasted. Assuming a well capacity of 150 gpm, around 37.5 gpm is waste. For the waste to be discharged to a water body there must be substantial natural dilution, since higher levels of fluoride can be hazardous to aquatic life and to irrigated crops.

Chloride

Chloride is present in groundwater from chloride rich sedimentary rock. Chloride, in high levels can cause a salty taste to the water. Drinking water standards regulate chloride levels to be under 250 mg/L. Chloride levels in groundwater from this region have been reported up to 396 mg/L.

Chloride can be removed by ion exchange, or by reverse osmosis. Reverse osmosis is the most common method of treatment, with about an 80% reduction anticipated.

The groundwater is pumped by the well, passed through a master meter and into the reverse osmosis treatment equipment. The budget equipment price is $165,000 uninstalled, for a 150 gpm well. The operating cost is around $0.75 per 1000 gal produced. This includes operating and power costs and membrane replacements. About 1 to 2 hours per day is needed by a treatment plant operator for this process.

Care must be practiced when disposing the waste stream into the sanitary sewer system. Levels of chloride over 180 mg/L can inhibit the nitrification process at a wastewater treatment plant. Chloride levels affecting the activated sludge process are not known.

With reverse osmosis, about 25% of the feed water will be wasted. Assuming a well capacity of 150 gpm, around 37.5 gpm is wasted.

Total Dissolved Solids

Total dissolved solids (TDS) are due to inorganic salts. TDS is regulated based on aesthetic standards. Groundwater containing TDS levels over 1000 mg/L is considered brackish. Drinking water standards regulate TDS levels to be under 500 mg/L. TDS levels in groundwater from this region have been reported up to 1303 mg/L. Total dissolved solids can be removed through ion exchange, reverse osmosis and distillation.

Distillation is the process of evaporating water from a saline solution and the condensation of the mineral-free vapor. Distillation is most commonly used in industrial applications. It requires a significant amount of energy for heating the water. Distillation is an expensive process, costing about $3 per 1000 gal produced.

Ion exchange is also most commonly used in industrial applications. The media bed required is a high pH resin, thus around four times as expensive as standard sodium resin. This process is very costly, with materials and operating, because it uses very high strength acids and bases.

For reverse osmosis, the groundwater is pumped by the well, passed through a master meter and into the treatment equipment. This system may require pretreatment of the raw water to adjust pH and prevent salt scaling. The budget equipment price is $230,000 uninstalled, for a 150 gpm well. The operating cost is around $0.75 per 1000 gal produced. This includes operating and power costs and membrane replacements. About 1 to 2 hours per day is needed by a treatment plant operator for this process.

With reverse osmosis, about 25% of the feed water will be wasted. Assuming a well capacity of 150 gpm, around 37.5 gpm is wasted.

Neutralization

As a result of the various water treatment processes, the pH may be lowered. The pH can be raised to an acceptable level before discharge into the water system by the addition of liquid caustic. Drinking water standards regulate pH levels to be between 6.5 and 8.5. pH levels in groundwater from this region have ranged from 6.2 to 8.

Waste Stream Characteristics

Sludge

Water treatment processes can generate sludge from suspended solids removed or from chemical precipitates created. Sludge is produced from the following processes: solids in filter backwash, iron coagulant sludge, and iron and manganese precipitates. In deciding which method of disposal is required for each type of sludge, several considerations must be given to: type of solids, quantity of sludge generated and sludge dewaterability.

Filter backwash makes up about 2% of the total water processed. Filter backwash contains a large volume of water, and a relatively small concentration of solids. A filter backwash recovery system is needed to recover the water and process the remaining solids.

For iron coagulant sludge, the amount formed is approximately 2.9 mg/L of solids formed for every mg/L of iron added. The sludge is stable and therefore often allowed to accumulate in basins for days or months, and removed intermittently. Generally, 60% to 90% of total solids are removed in sedimentation basin, with the remaining being removed in the filters. The backwash water will contain solids at around 35 to 83 lbs/million gallons treated water.

Iron and manganese precipitation produces 1.5 to 2 mg/L of sludge for each mg/L of iron or manganese in solution. The sludge can be removed in sedimentation tanks or in filters.

Brine

Water treatment processes can also produce brine wastes from membrane and ion exchange processes. The volume of brine may range from 3% to 10% of the treated water. The amount of brine produced from membrane processes will vary depending on the type of membrane. For reverse osmosis, the system recovery rate is approximately 70% to 75%. The brine waste produced from ion exchange ranges from 1.5% to 10% of the treated water.

Waste Stream Disposal

Generic disposal costs are difficult to estimate because options vary significantly between different projects. Prior to implementation, a review of pertinent regulations regarding disposal and associated water quality issues should be completed to ensure that the proposed disposal method is appropriate for planning purposes.

Sludge Disposal

Four methods for sludge disposal are available: land application, discharge to a sanitary sewer, discharge to permanent lagoons and burial in a landfill.

For land application, a TCEQ permit would be required. The sludge is generally spray-applied, and application rates are limited to the agronomic needs of the cover crop.

Discharge of the waste stream to the sanitary sewer is a common method of disposal. This discharge will require coordination with the wastewater treatment plant authorities to prevent the disruption of the treatment process. The additional liquid and solids load will also increase the operational and maintenance costs at the plant.

If enough land is available, the sludge may be diverted to lagoons, where the solids concentration can be increased by returning the supernate to the treatment process. After time, the lagoons will eventually be filled. Dependant upon TCEQ approval, the lagoon may then be covered and closed in-place, or the sludge must be removed to an approved landfill or land application site.

To dispose of sludge in a sanitary landfill, the sludge must first be concentrated into cake form. The sludge must pass a paint-filter test for consistency and must pass a TCLP test to show it is non-hazardous. The dried sludge is then hauled to a licensed landfill by a licenses waste handler.

Brine Disposal

Disposal options for brine include discharge to a natural waterway, evaporation, discharge to an injection well and discharge to the municipal wastewater system. A permit would be required to discharge into a natural waterway. This disposal method has a low upfront cost, but requires a monitoring program, a TCEQ permit and a licensed wastewater operator.

Where surface discharge is not possible, evaporation ponds can be used. Evaporation ponds are more appropriate for smaller volume flows and regions with high evaporation rates. Groundwater protection laws require that the ponds be lined.

If the brine does not contain hazardous constituents, it may be disposed of with an injection well. Injection wells have a very high capital cost and a TCEQ permit would be needed to show that the waste will not adversely affect an underground water source.

Discharging brine to the municipal wastewater system would require coordination with the local treatment authority. Analysis of the effect of the brine on the treatment process would be necessary and discharges which inhibit the wastewater treatment process are prohibited. This method of disposal has a low capital cost, but may impact the treatment process and will increase wastewater treatment costs.

Table 1: Phone Survey Results

Entity	County	Comment
Redwater	Bowie	No problems with water quality or quality in test wells. Some surface water, but customers are more interested in consistency rather than source. No THM problems. Don't know what customers would be willing to pay to increase water quality.
Bi County WSC	Camp	No problems with water quality or quality in test wells. No surface water. Some THM on southern end of the of transmission lines.
Cypress Springs WSC	Franklin	Have some iron problems, only use one well in the system. Several test wells in the past have had iron problems. Customers prefer surface water. No THM problems from the well. Does not know what customers might pay for better water.
Bethel Ash WSC	Henderson	No water quality problems, except some manganese color. No test wells have had bad quality. No surface water, does not know what customers prefer.
Miller Grove WSC	Hopkins	No water quality problems. No test well water quality problems. No THM problems. Does not know what customers prefer.
Shirley WSC	Hopkins	No water quality problems in wells or test wells. No surface water. No THM. Customers prefer consistent water, and would not like an increase in rates.
North Hunt WSC	Hunt	Two Woodbine wells, no water quality problems. No test wells have been drilled. Could get surface water, but don't know what customers prefer or would pay for. Disinfect with chloramine -- no THM.
Commerce	Hunt	Nacatoch wells, no water quality problems. No test wells. Customers prefer what they're used to. No THM problems from well water.
Bright Star-Salem WSC	Rains	Iron and manganese over secondary limits. They treat the manganese with sequestrant and filter the iron. No test wells have been drilled. Trying to raise rates in $0.50 increments. No THM problems.
Clarksville	Red River	No groundwater quality problems. No quality problems with test wells. No surface water, don't know what customers would prefer. No THM problems in groundwater.
Red River WSC	Red River	No groundwater quality problems in production wells. One test well in the Nacatoch had water quality problems. Some surface water is purchased, customers usually prefer groundwater because it is softer. No THM problems from groundwater.
Ben Wheeler WSC	Van Zandt	No groundwater quality problems, except iron often above secondary limit. Had iron in test wells completed in 1970s. No surface water. Don't know what customers would be willing to pay for better water. No THM problems in groundwater.
Canton	Van Zandt	Only surface water.
Fruitvale WSC	Van Zandt	No groundwater quality problems, have 12 wells in Carrizo-Wilcox. No test well problems. No surface water. Don't think customers would pay for better water quality. No THM problems.
Mac Bee WSC	Van Zandt	No water quality problems, but about 95% surface water. Customers prefer surface water. Don't know how much customers would pay for better water. No THM problems.
Van	Van Zandt	No groundwater quality problems. No quality problems with test wells. No surface water in this system. Customers don't want higher rates. No THM problems.

Sharon WSC	Wood	No groundwater quality problems. No test well quality problems. No surface water. Don't know what customers would accept in terms of higher rates. No THM problems.
Lake Fork WSC	Wood	No groundwater quality problems. No test wells. No surface water, don't know what customers would prefer. Since water quality not a problem, customers would not pay for better quality. No THM problems.
Jones WSC	Wood	No groundwater quality problems. No test wells. Strictly groundwater. Customers prefer groundwater. No THMs.
Golden WSC	Wood	Older wells have good water quality, one new well has chloride problem. had chloride problem in some test wells. Strictly on groundwater, don't know what customers would be willing to pay for better water. Have THM problems in the line sometimes.
Elderville WSC	Gregg	No groundwater quality problems. No test wells. 90% surface water -- customers prefer surface water. Combined water testing, don't know about THM specifically in groundwater. No THM problems so far.
Kilgore	Gregg	No problems with groundwater quality. No test well quality problems. Customers prefer groundwater, and would not likely pay a lot to improve water quality. No THM problems with groundwater.
Liberty City WSC	Gregg	Have some TDS problems in existing wells. No test wells that were abandoned due to quality problems. No surface water, don't know what customers would be willing to pay to improve quality. There have been some THM problems, going to chloramine to resolve these.
Caddo Lake WSC	Harrison	No groundwater problems. No test wells. Don't know if customers would prefer groundwater or surface water. No THM problems.
Diana WSC	Harrison	No groundwater quality problems. No test wells. All groundwater, customers haven't complained. Have had some THM problems; these are coming down with increased flushing.
Gum Springs WSC	Harrison	No groundwater quality problems. No test wells. About half surface water; customers prefer what they are used to. No THM problems.
Hallsville	Harrison	No groundwater quality problems. In 1974 a well drilled into the Wilcox went too deep and produced bad quality. Went higher and was better. About 65% of water is surface water from Longview. Customers like water to be consistent. No THM problems.
Harleton WSC	Harrison	Have had some hydrogen sulfide problems, and some wells with elevated chloride (but not over the secondary limit). Several test wells had water quality problems. Combined surface and well water, customers seem to prefer consistency. No THMs from groundwater.
West Harrison	Harrison	No groundwater quality problems. No test well quality problems. Strictly groundwater, customers prefer groundwater. No THM problems.
Jefferson	Marion	Not running plant anymore, did not have quality problems when they were.
Mims WSC	Marion	No groundwater.
Kellyville Berea WSC	Marion	No groundwater quality problems. No test wells. All groundwater, don't know what customers prefer or would be willing to pay for better quality. Have had some THM problems, are adding ammonia to deal with this.
Lone Star	Morris	No groundwater.
Crystal Systems	Smith	No groundwater quality problems. No test wells. No surface water. Doesn't think customers would want rate increase for better water. No THM problems.
Lindale	Smith	No groundwater quality problems. No test well quality problems. No surface water. No THM problems.

Lindale Rural WSC	Smith	No groundwater quality problems. No test wells. No surface water. No THM problems.
Starville Friendship WSC	Smith	Three wells, no groundwater quality problems. No test wells. No surface water, don't know what customers would be willing to pay to improve water quality. No THM problems.
East Mountain	Upshur	High chlorides (about 400 mg/L) in one well. Some test wells did not work out due to chloride content. No surface water. No THM problems.
Ore City	Upshur	No groundwater quality problems, one well has musty odor. No water quality problems in test wells. Don't know how much customers would be willing to pay for better water. Customers seem to prefer well water. No THM problems.
Holly Ranch Water Co.	Wood	One well offline due to turbidity problems. No test well problems. Customers seem to prefer well water, don't know how they would feel about surface water, or how much they would be willing to pay to improve water. No THM problems.
Mineola	Wood	No groundwater quality problems. One test well in 1978 didn't work out due to high iron, TDS. No surface water, four wells. Customers like groundwater, don't know how much they would pay for better water. No THM problems.
New Hope WSC	Wood	All wells have high iron, manganese, hydrogen sulfide, and low pH. Test wells have the same problem. All wells are in the Carrizo-Wilcox. Water is treated and filtered. Customers don't seem to mind as long as water is treated. No THM problems.

Table 2: Carrizo-Wilcox Water Quality Results

MCL Class	Constituent	Limit	Units	Total Results	Results over MCL	% Over	Average	Median
primary	Alpha	15	pc/L	67	0	0.0%	< 3	< 2
primary	Arsenic	10	µg/L	246	0	0.0%	< 10	< 10
primary	Barium	2000	µg/L	171	0	0.0%	74	37
primary	Cadmium	5	µg/L	191	2	1.0%	< 4	< 1
primary	Chromium	100	µg/L	195	0	0.0%	< 10	< 5
primary	Lead	15	µg/L	188	2	1.1%	< 3	< 1
primary	Nitrate as N	10	mg/L	615	7	1.1%	1	0.050
primary	Selenium	50	µg/L	188	1	0.5%	< 4	< 4
secondary	Chloride	300	mg/L	665	13	2.0%	55	22
secondary	Copper	1000	µg/L	192	0	0.0%	< 12	5.0
secondary	Fluoride	2	mg/L	626	1	0.2%	0.3	0.2
secondary	Iron	300	µg/L	574	92	16.0%	533	60
secondary	Manganese	50	µg/L	319	38	11.9%	50	20
secondary	pH	6.5 - 8.5		627	171	27.3%	7.8	8
secondary	Sulfate	300	mg/L	665	6	0.9%	41	16
secondary	Total Dissolved Solids	1000	mg/L	665	4	0.6%	373	303

Table 3: Trinity Water Quality Results

MCL Class	Constituent	Limit	Units	Total Results	Results over MCL	% Over	Average	Median
primary	Alpha	15	pc/L	4	0	0%	6.6	5.2
primary	Arsenic	10	µg/L	5	0	0%	< 2	< 2
primary	Barium	2000	µg/L	5	0	0%	52.8	65
primary	Cadmium	5	µg/L	5	0	0%	< 0.8	< 1
primary	Chromium	100	µg/L	5	0	0%	< 4.1	2.03
primary	Lead	15	µg/L	5	0	0%	< 2.6	< 1
primary	Nitrate as N	10	mg/L	17	0	0%	< 0.13	0.03
primary	Selenium	50	µg/L	5	0	0%	< 4	< 4
secondary	Chloride	300	mg/L	17	4	24%	396.2	125
secondary	Copper	1000	µg/L	5	0	0%	6.6	6
secondary	Fluoride	2	mg/L	17	8	47%	2.1	1.5
secondary	Iron	300	µg/L	11	3	27%	1254	50
secondary	Manganese	50	µg/L	10	3	30%	< 107	< 50
secondary	pH	6.5 - 8.5		17	0	0%	7.8	7.8
secondary	Sulfate	300	mg/L	17	0	0%	90	70
secondary	Total Dissolved Solids	1000	mg/L	17	10	59%	1182	1090

Table 4: Queen City-Sparta Water Quality Results

MCL Class	Constituent	Limit	Units	Total Results	Results over MCL	% Over	Average	Median
primary	Alpha	15	pc/L	26	0	0.0%	3	3
primary	Arsenic	10	µg/L	51	0	0.0%	< 2	< 2
primary	Barium	2000	µg/L	51	0	0.0%	85	62.1
primary	Cadmium	5	µg/L	39	0	0.0%	< 2	< 1
primary	Chromium	100	µg/L	39	0	0.0%	2	1.6
primary	Lead	15	µg/L	50	3	6.0%	4	2.49
primary	Nitrate as N	10	mg/L	160	8	5.0%	2	0.77
primary	Selenium	50	µg/L	39	0	0.0%	< 4	< 4
secondary	Chloride	300	mg/L	180	0	0.0%	21	11
primary	Copper	1000	µg/L	51	1	2.0%	52	7.8
secondary	Fluoride	2	mg/L	156	0	0.0%	0	0.1
secondary	Iron	300	µg/L	117	26	22.2%	1171	60
secondary	Manganese	50	µg/L	58	8	13.8%	33	11.05
secondary	pH	6.5 - 8.5		149	89	59.7%	6.2	6.2
secondary	Sulfate	300	mg/L	180	2	1.1%	30	8.1
secondary	TDS	1000	mg/L	180	1	0.6%	155	103.5

Table 5: Blossom Water Quality Results

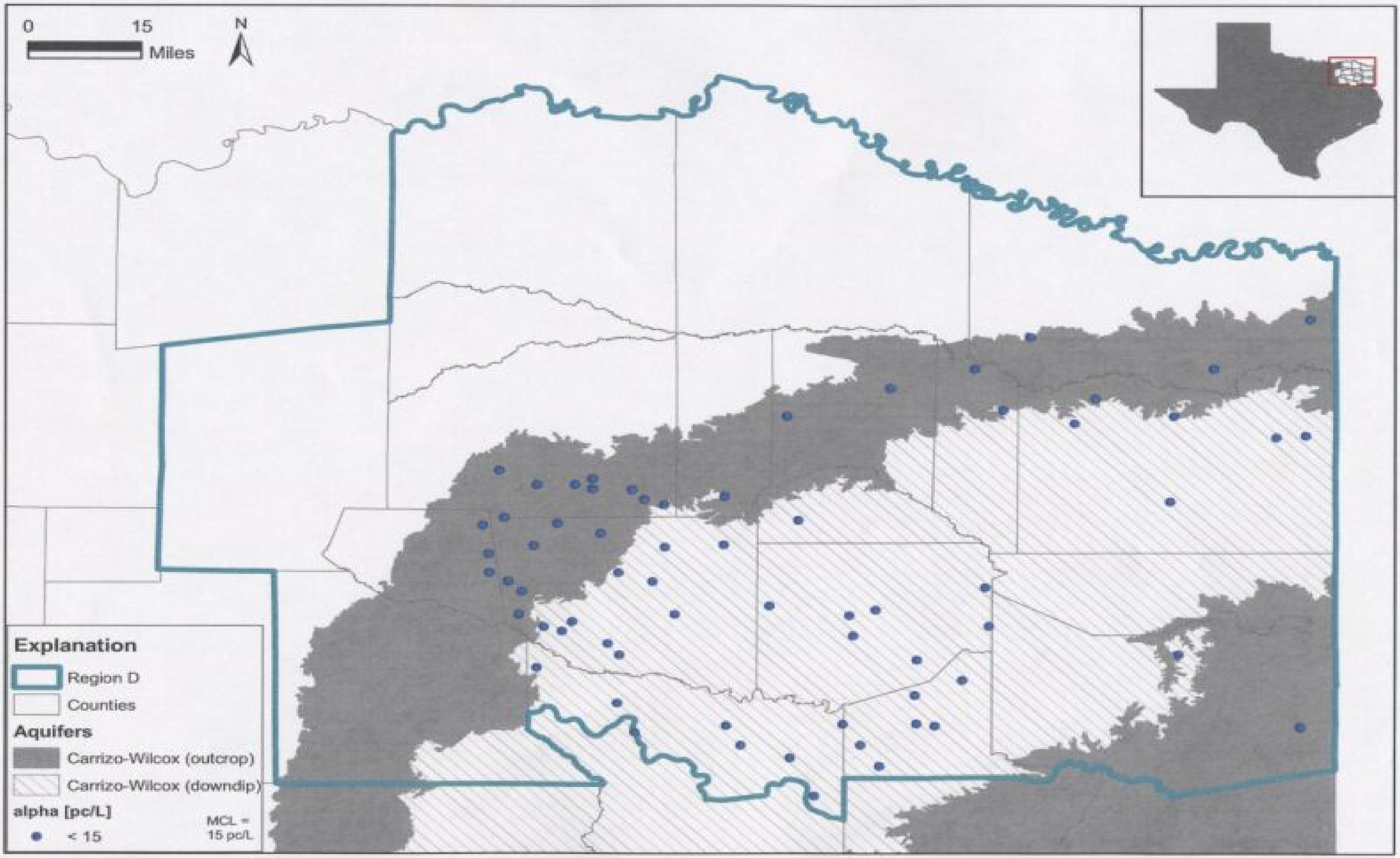
MCL Class	Constituent	Limit	Units	Total Results	Results over MCL	% Over	Average	Median
primary	Alpha	15	pc/L	5	0	0%	< 2	< 3
primary	Arsenic	10	µg/L	7	1	14%	< 5	< 2
primary	Barium	2000	µg/L	7	0	0%	41	11.6
primary	Cadmium	5	µg/L	6	0	0%	< 1	< 1
primary	Chromium	100	µg/L	6	0	0%	< 3	2.99
primary	Lead	15	µg/L	7	0	0%	< 2	< 1
primary	Nitrate as N	10	mg/L	60	1	2%	0.8	0.09
primary	Selenium	50	µg/L	7	0	0%	< 5	< 4
secondary	Chloride	300	mg/L	61	11	18%	374	73
secondary	Copper	1000	µg/L	7	0	0%	5.0	3.07
secondary	Fluoride	2	mg/L	60	8	13%	0.8	0.5
secondary	Iron	300	µg/L	14	6	43%	13113	187
secondary	Manganese	50	µg/L	9	1	11%	309	7
secondary	pH	6.5 - 8.5		60	15	25%	7.8	8.0
secondary	Sulfate	300	mg/L	61	11	18%	280	98
secondary	Total Dissolved Solids	1000	mg/L	61	23	38%	1303	583

Table 6: Nacatoch Water Quality Results

MCL Class	Constituent	Limit	Units	Total Results	Results over MCL	% Over	Average	Median
primary	Alpha	15	pc/L	21	0	0.0%	< 2.5	< 2
primary	Arsenic	10	µg/L	28	0	0.0%	< 3.5	< 2
primary	Barium	2000	µg/L	28	0	0.0%	29	< 20
primary	Cadmium	5	µg/L	23	0	0.0%	< 1.2	< 1
primary	Chromium	100	µg/L	27	0	0.0%	< 10	2.66
primary	Lead	15	µg/L	25	0	0.0%	< 1.5	< 1
primary	Nitrate as N	10	mg/L	167	3	1.8%	0.61	0.02
primary	Selenium	50	µg/L	29	0	0.0%	< 4.3	< 4
secondary	Chloride	300	mg/L	170	40	23.5%	219	104.5
secondary	Copper	1000	µg/L	29	0	0.0%	9	4.8
secondary	Fluoride	2	mg/L	163	39	23.9%	1.3	0.7
secondary	Iron	300	µg/L	67	10	14.9%	865	51
secondary	Manganese	50	µg/L	44	1	2.3%	20	12.3
secondary	pH	6.5 - 8.5		166	74	44.6%	8.4	8.5
secondary	Sulfate	300	mg/L	170	12	7.1%	82	22.5
secondary	Total Dissolved Solids	1000	mg/L	170	51	30.0%	883	733

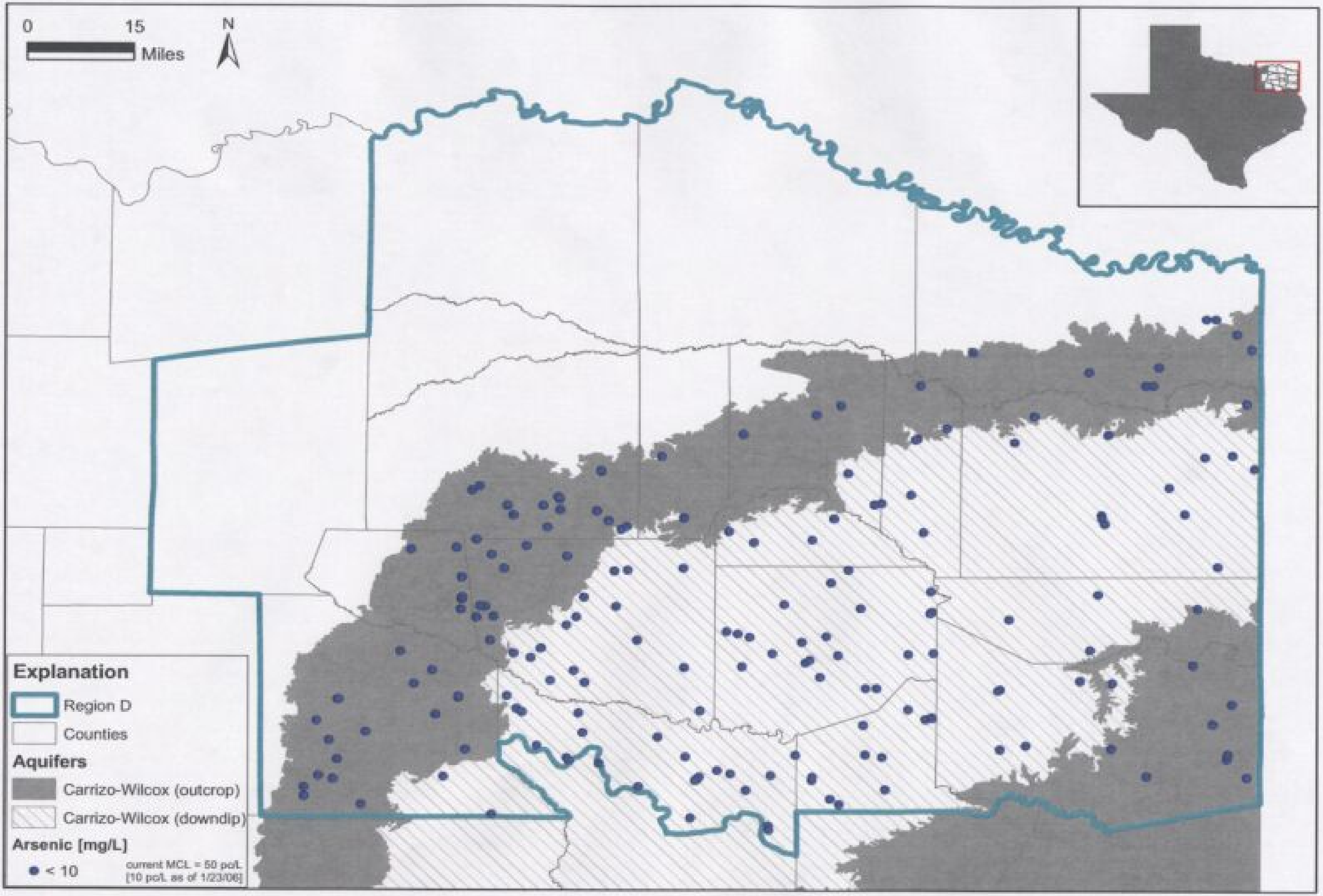
Table 7: Woodbine Water Quality Results

MCL Class	Constituent	Limit	Units	Total Results	Results over MCL	% Over	Average	Median
primary	Alpha	15	pc/L	6	0	0.0%	< 2	2.3
primary	Arsenic	10	µg/L	6	0	0.0%	< 2	< 2
primary	Barium	2000	µg/L	6	0	0.0%	116	19
primary	Cadmium	5	µg/L	6	0	0.0%	< 1	< 1
primary	Chromium	100	µg/L	6	0	0.0%	< 2	1.1
primary	Lead	15	µg/L	6	0	0.0%	< 1.2	< 1
primary	Nitrate as N	10	mg/L	12	0	0.0%	0	0.1
primary	Selenium	50	µg/L	6	0	0.0%	5	4.0
secondary	Chloride	300	mg/L	12	1	8.3%	156	139
secondary	Copper	1000	µg/L	6	0	0.0%	13	7.7
secondary	Fluoride	2	mg/L	12	3	25.0%	2	1.5
secondary	Iron	300	µg/L	9	3	33.3%	370	100
secondary	Manganese	50	µg/L	8	0	0.0%	14	9.4
secondary	pH	6.5 - 8.5		12	3	25.0%	7.5	8.1
secondary	Sulfate	300	mg/L	12	2	16.7%	293	162
secondary	Total Dissolved Solids	1000	mg/L	12	5	41.7%	1061	865



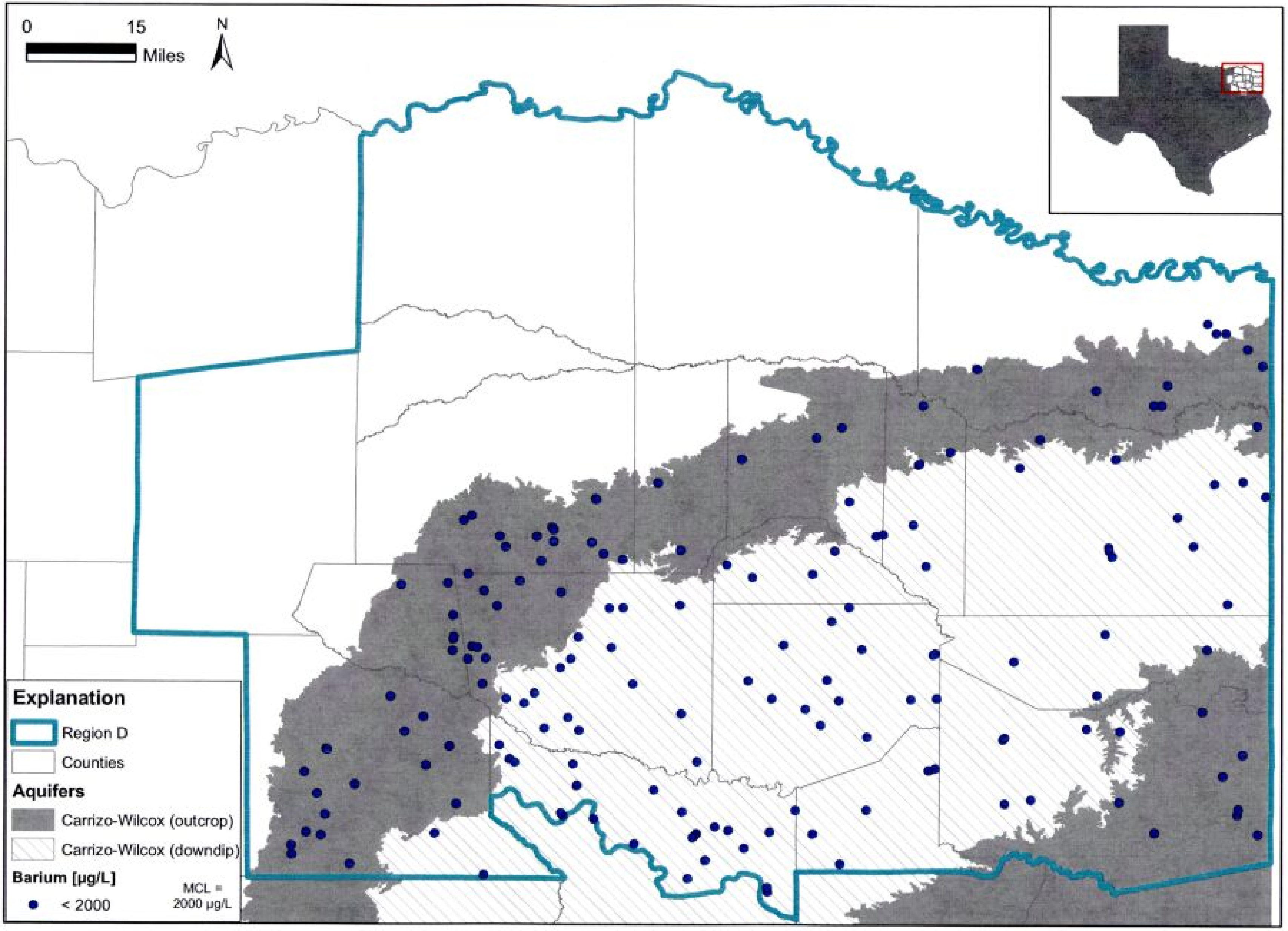
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.1



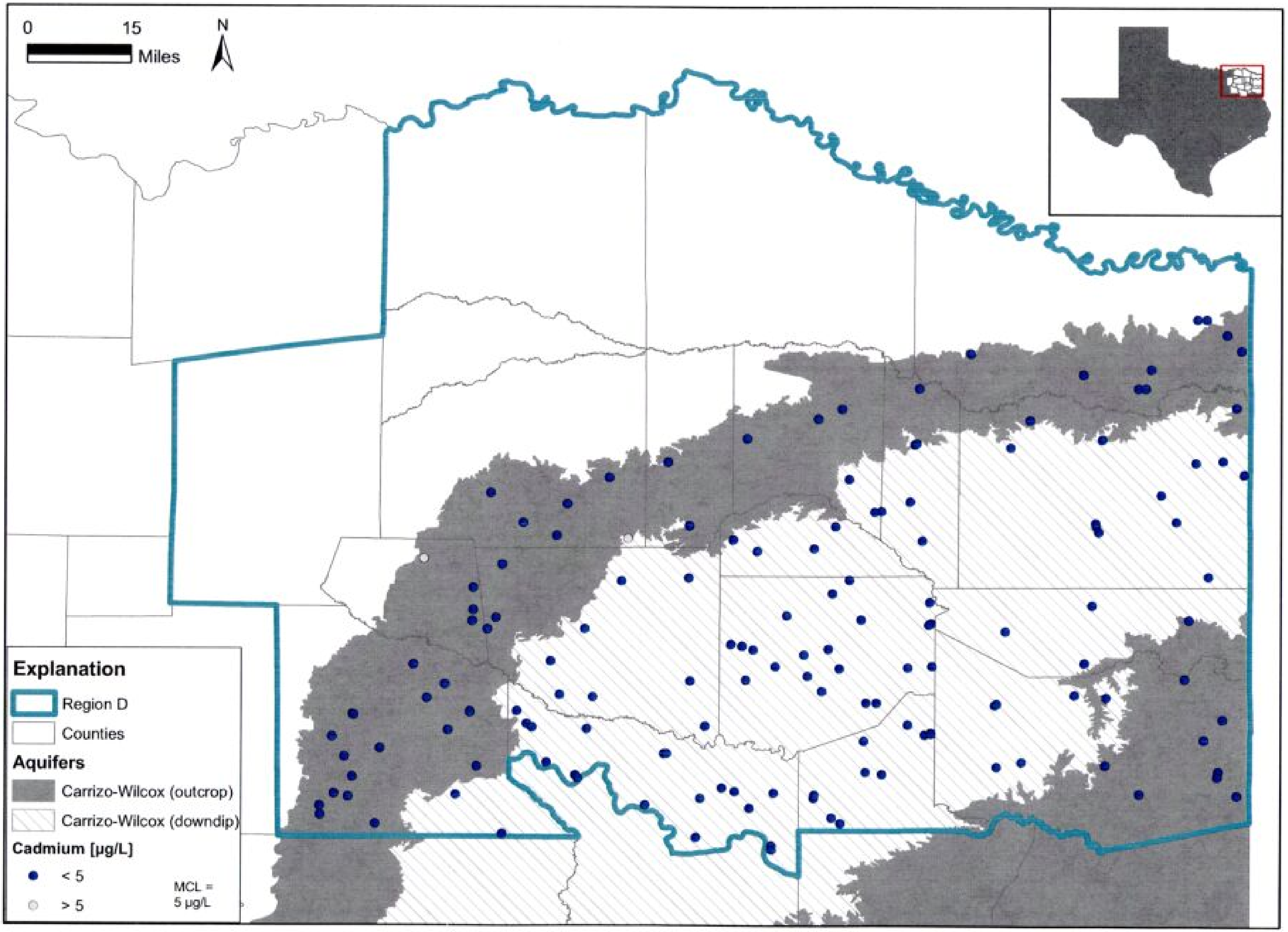
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.2



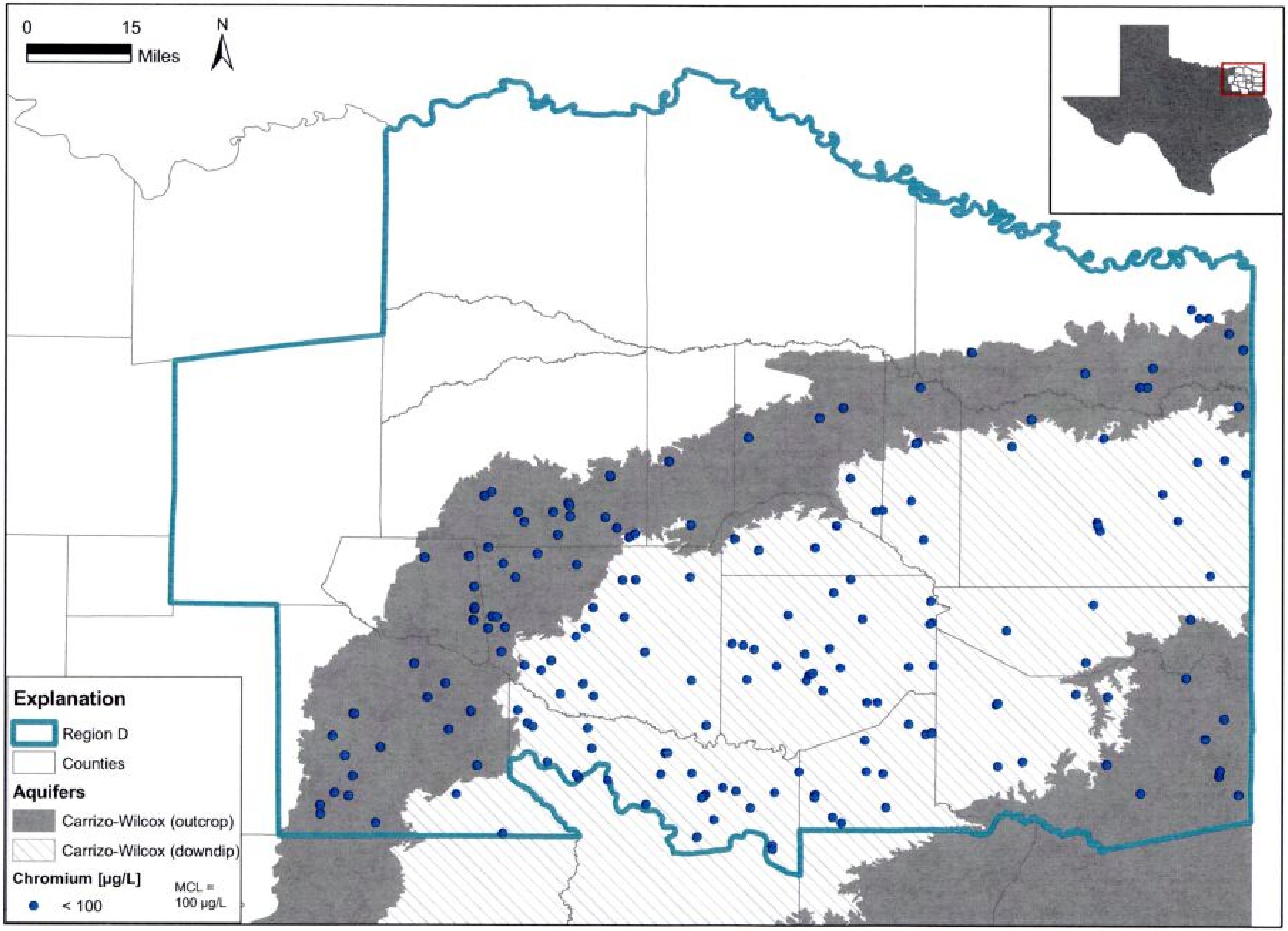
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.3



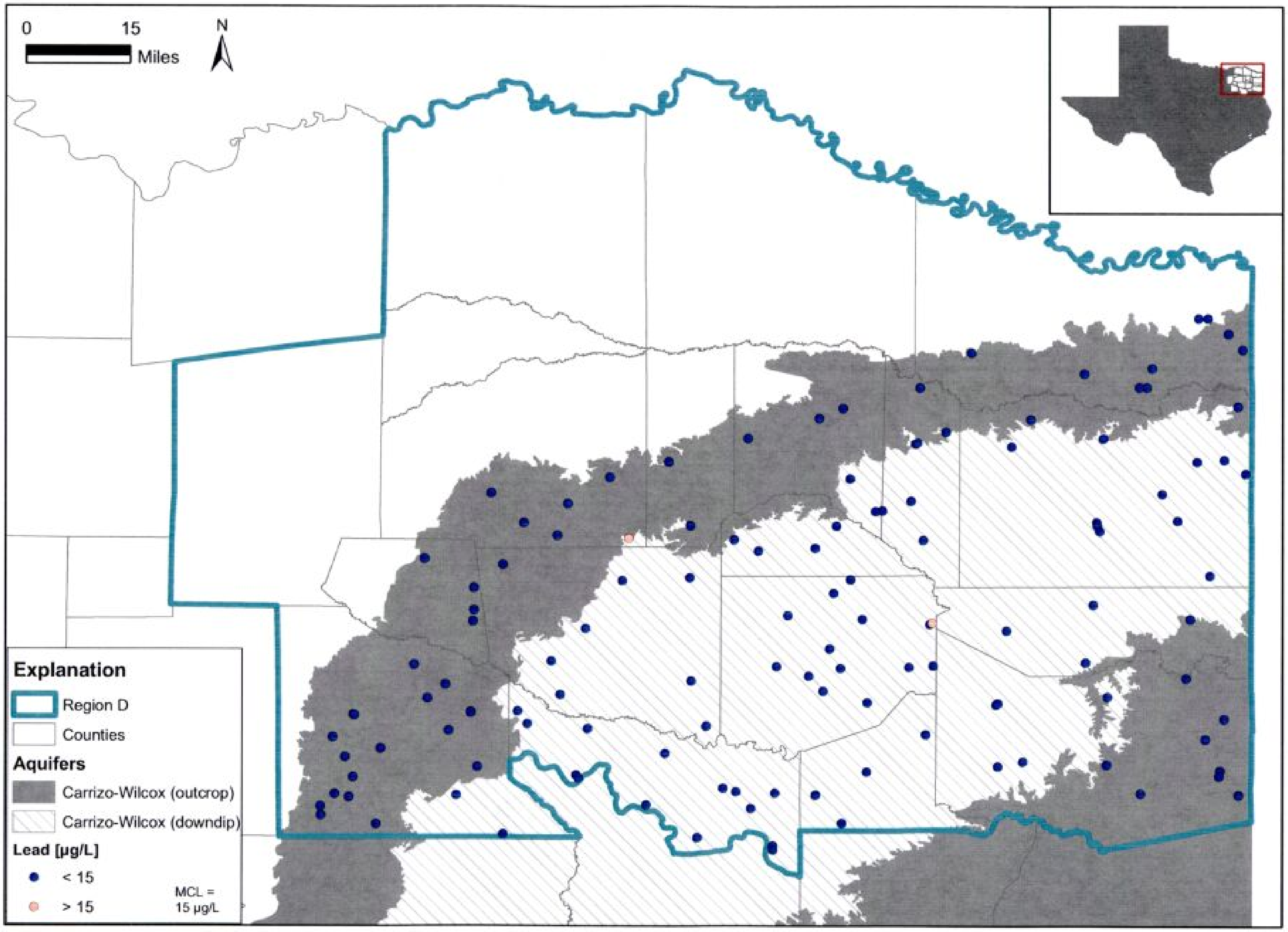
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.4



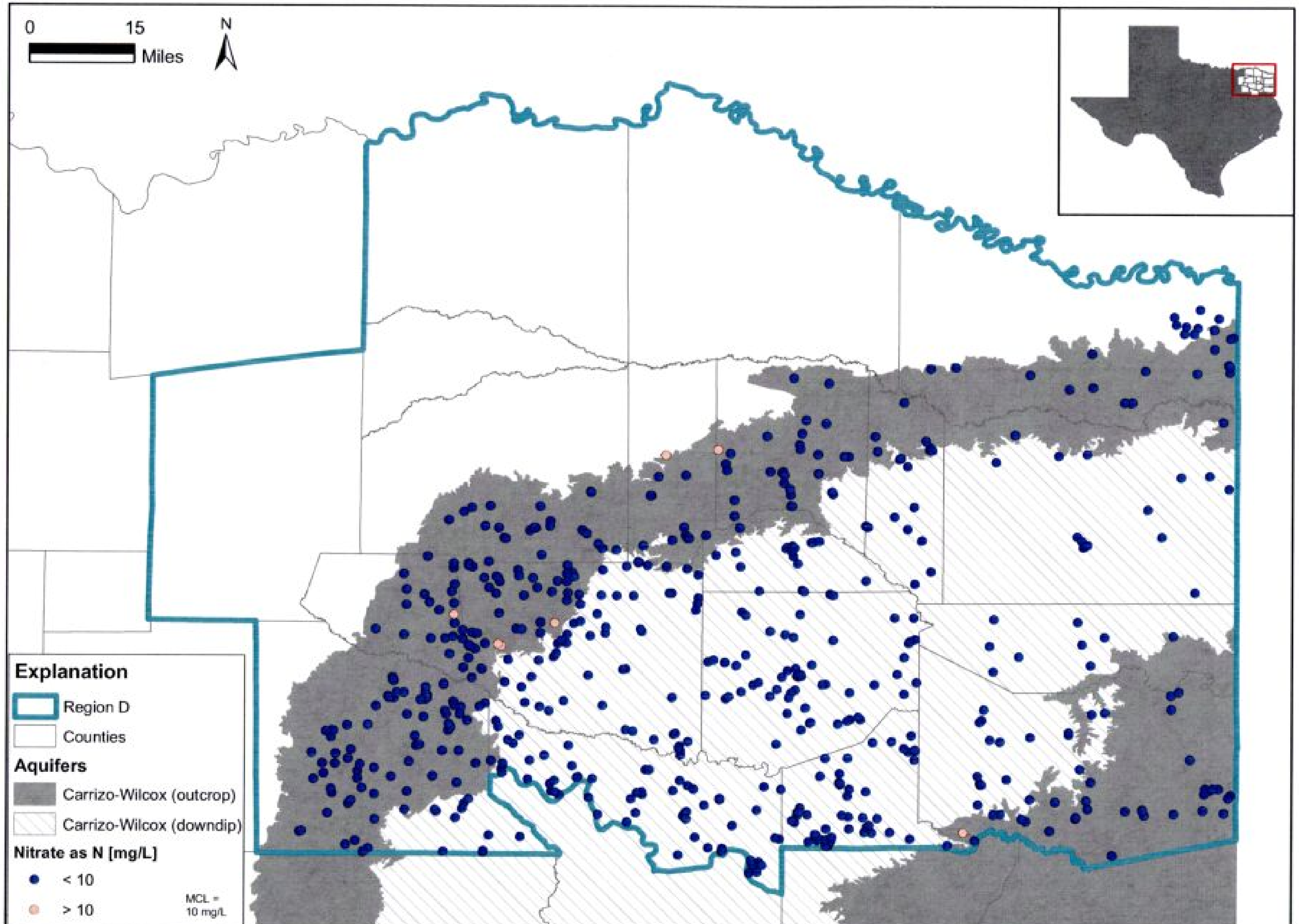
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.5



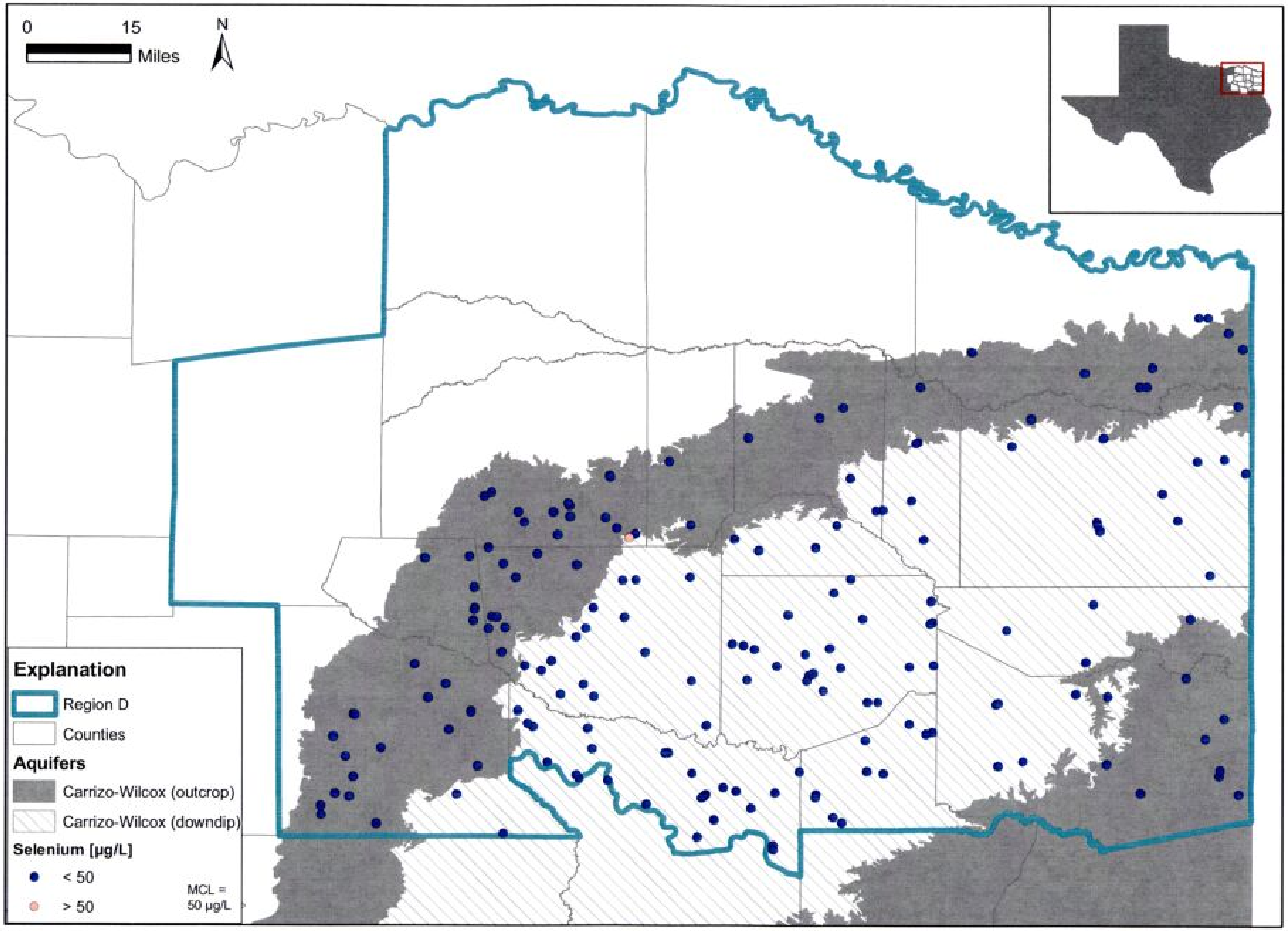
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.6



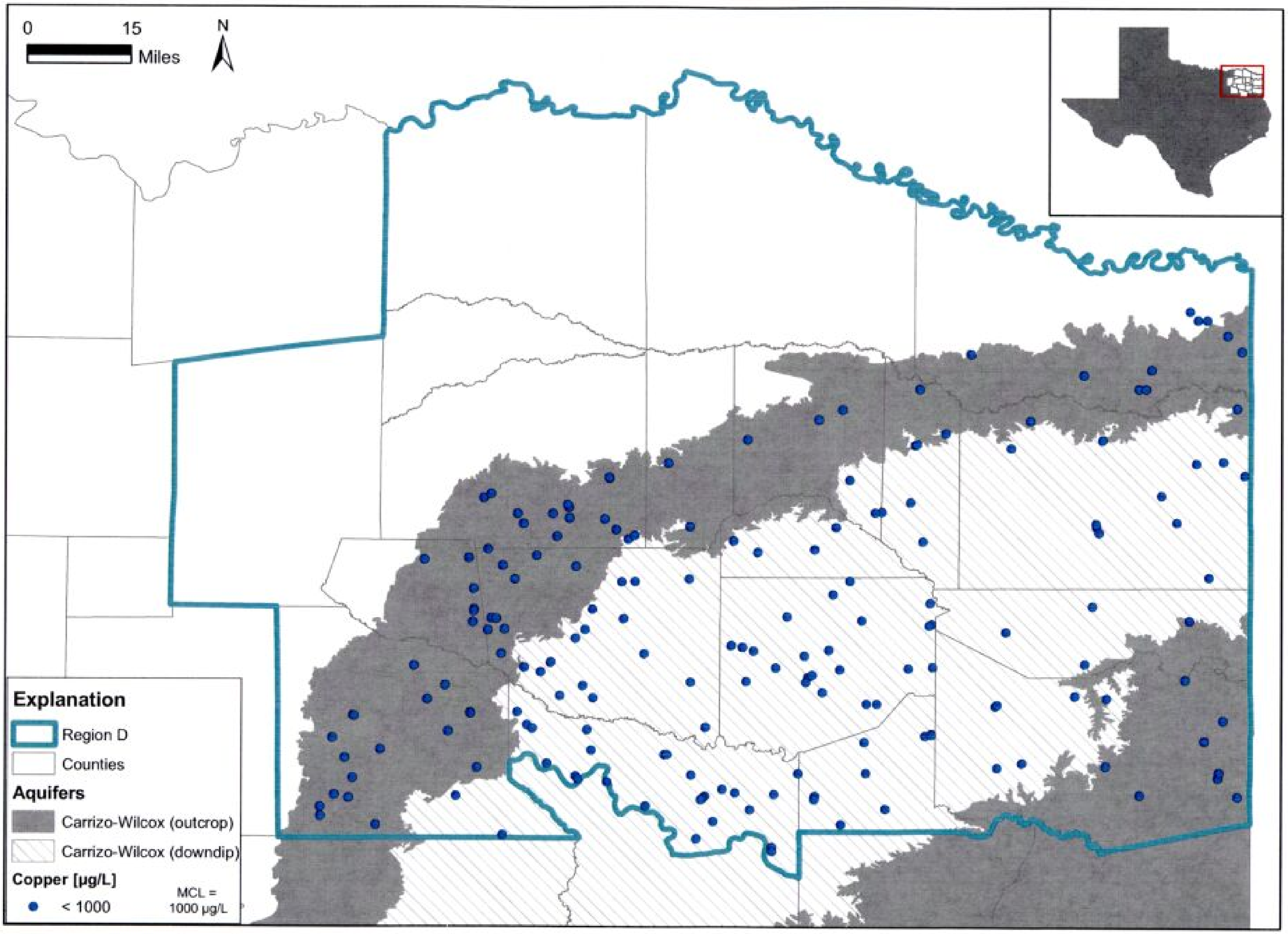
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.7



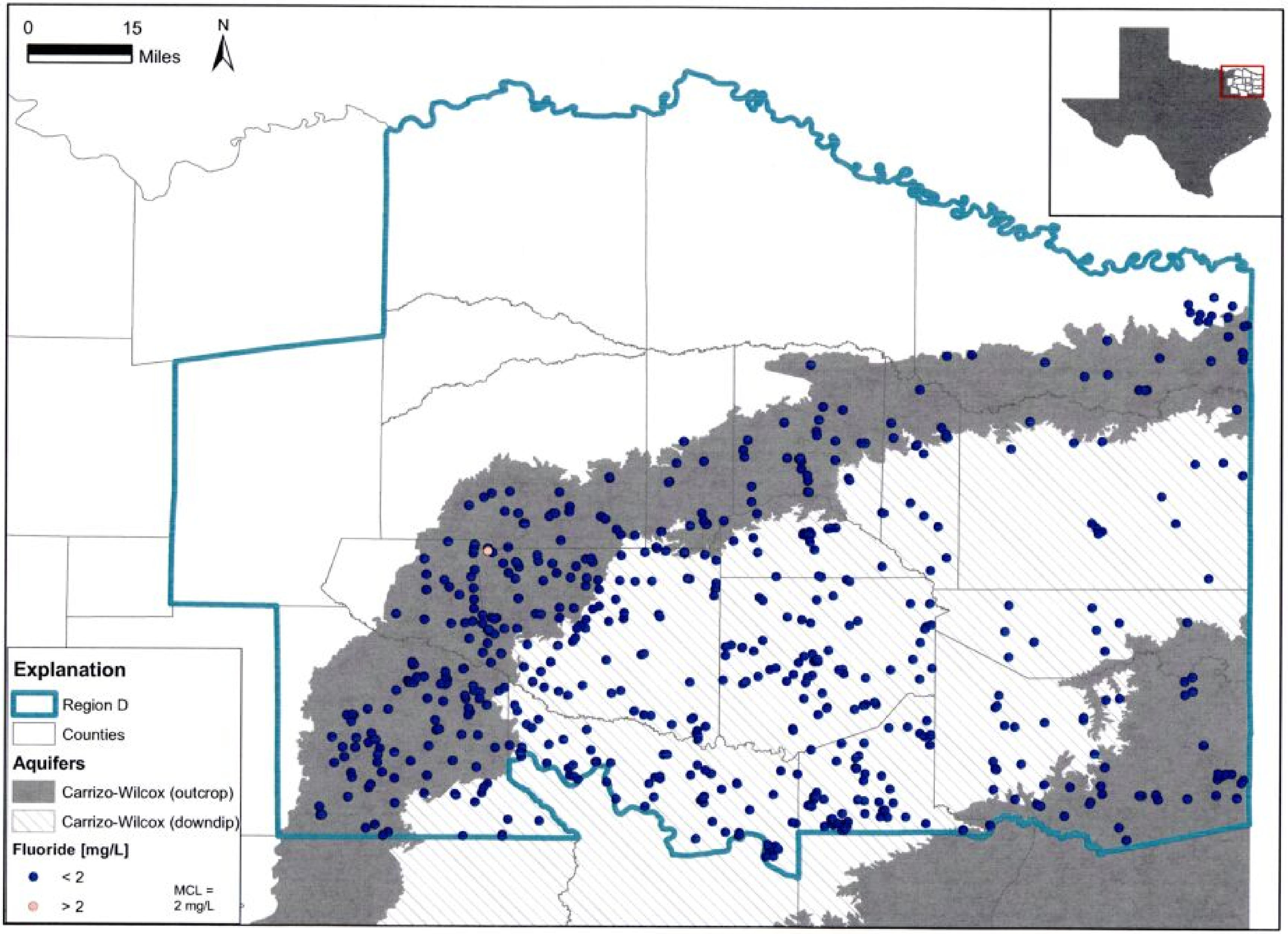
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.8



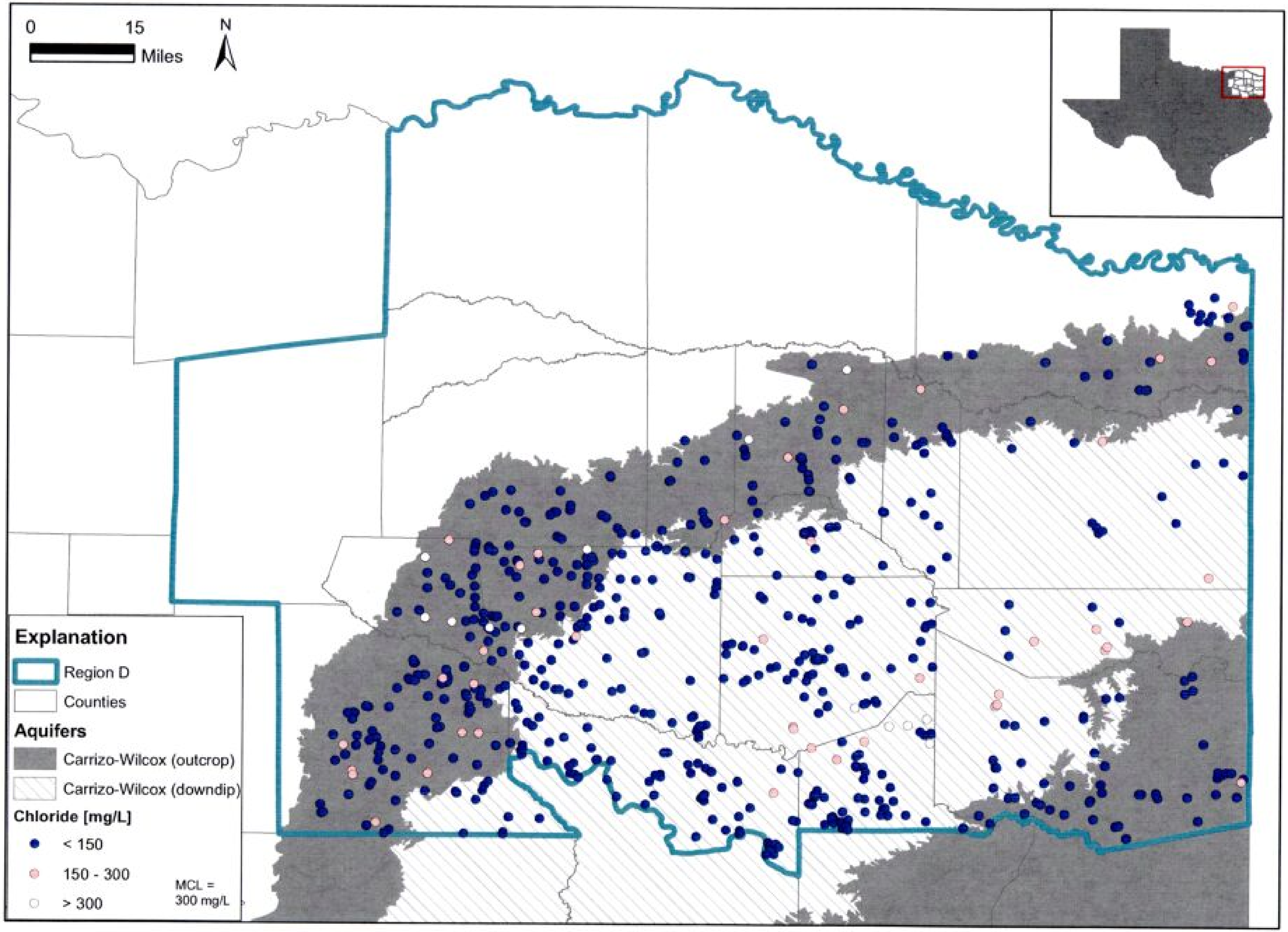
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.9



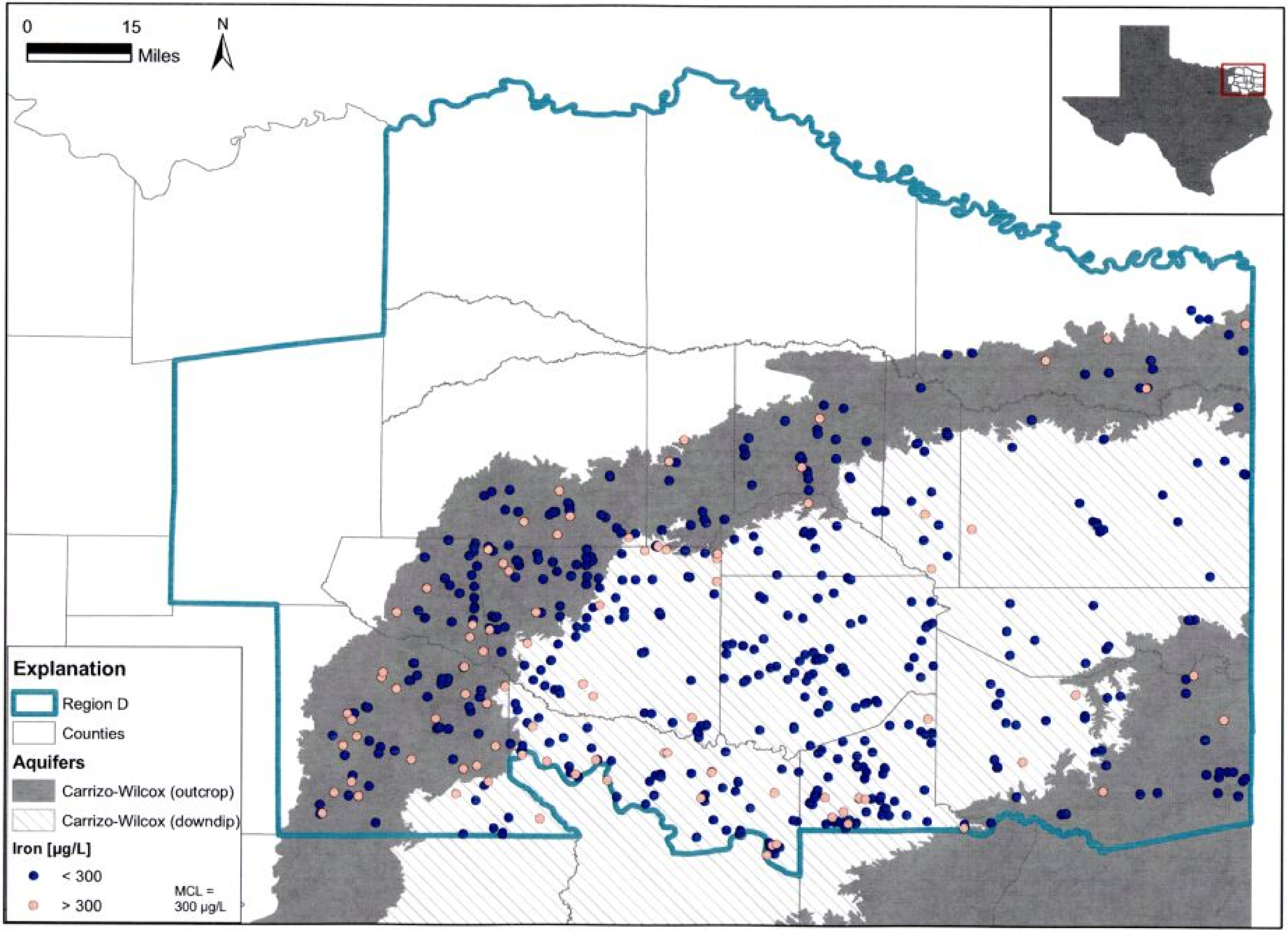
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.10



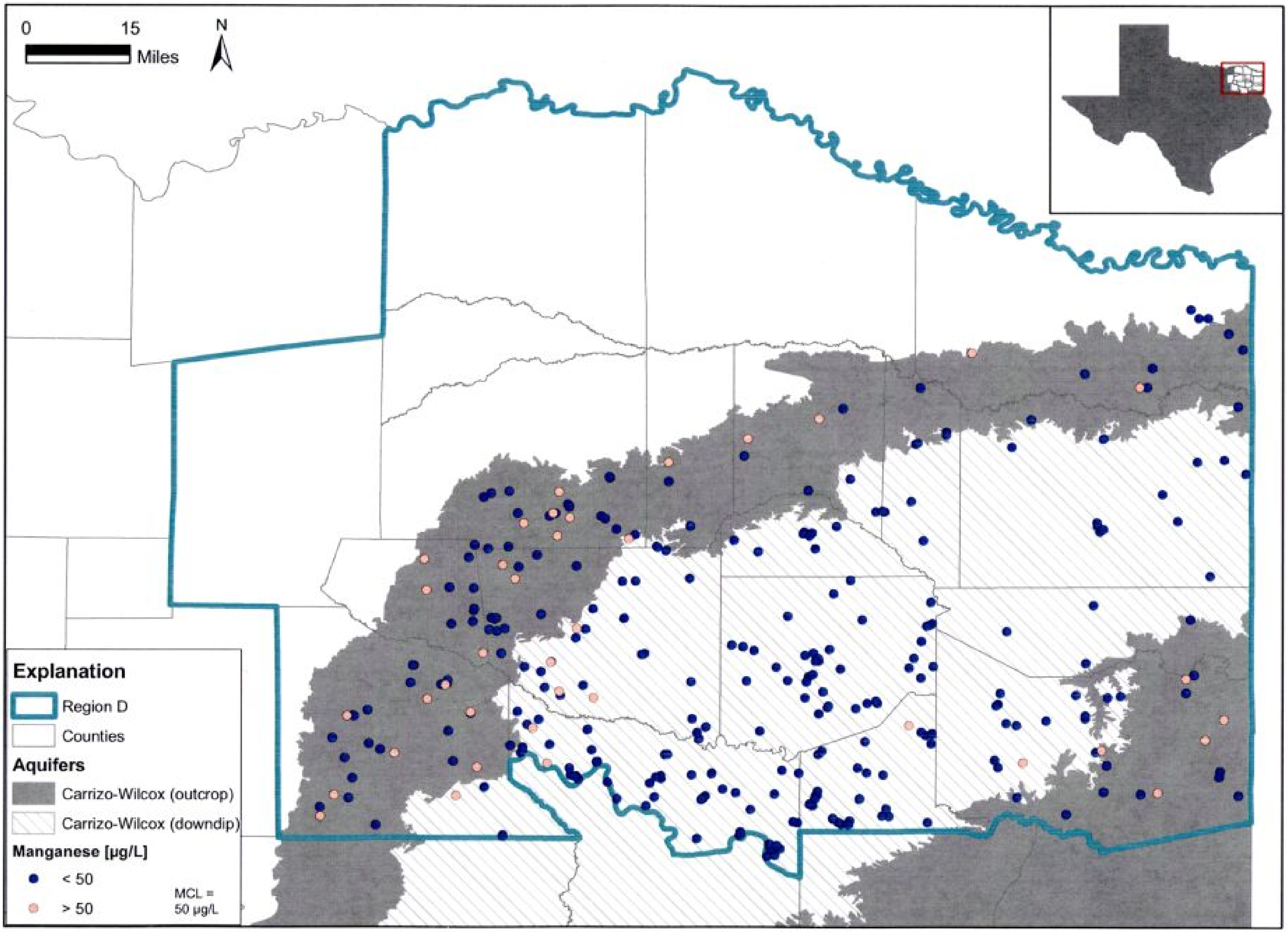
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.11



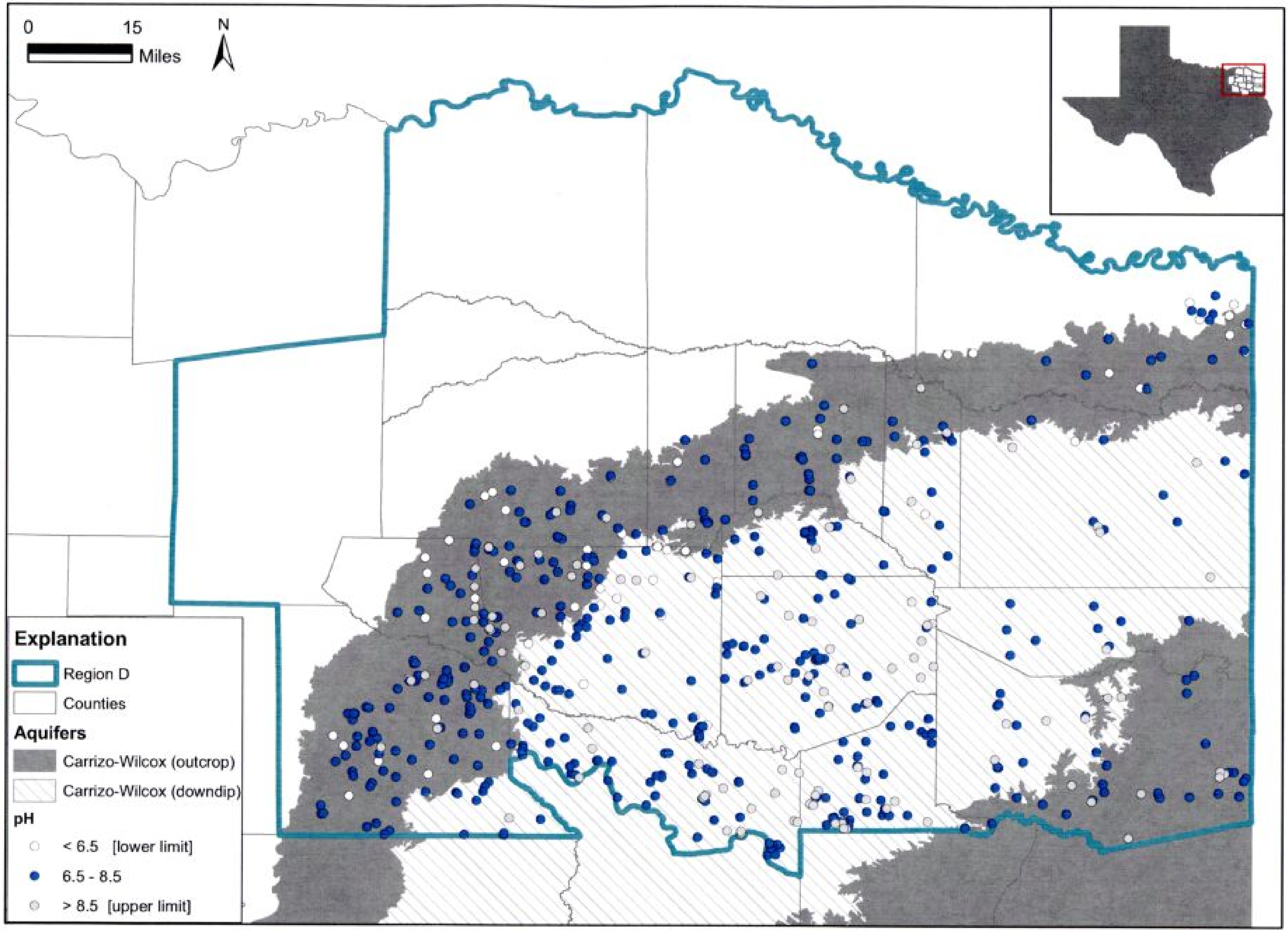
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.12



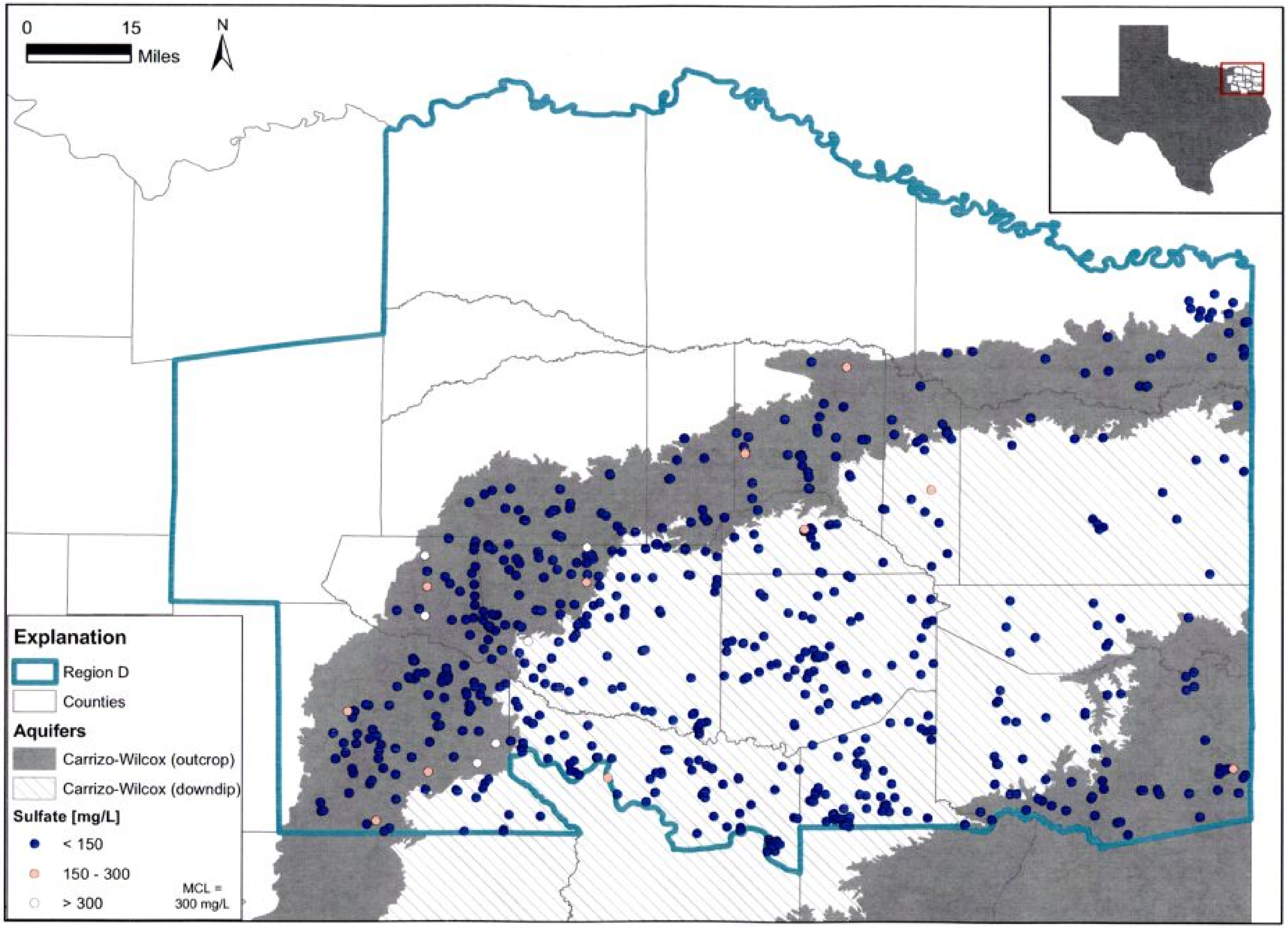
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.13



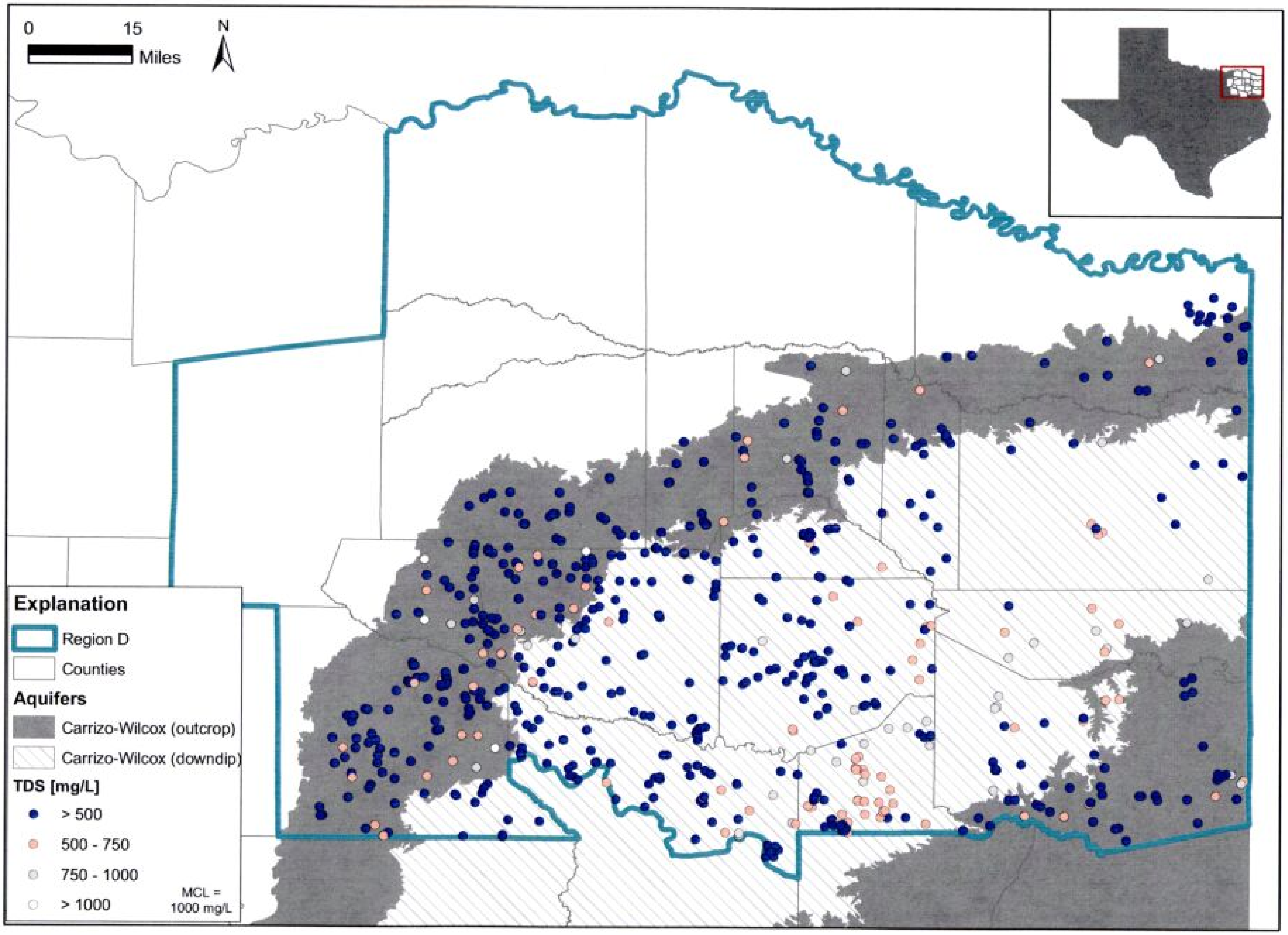
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.14



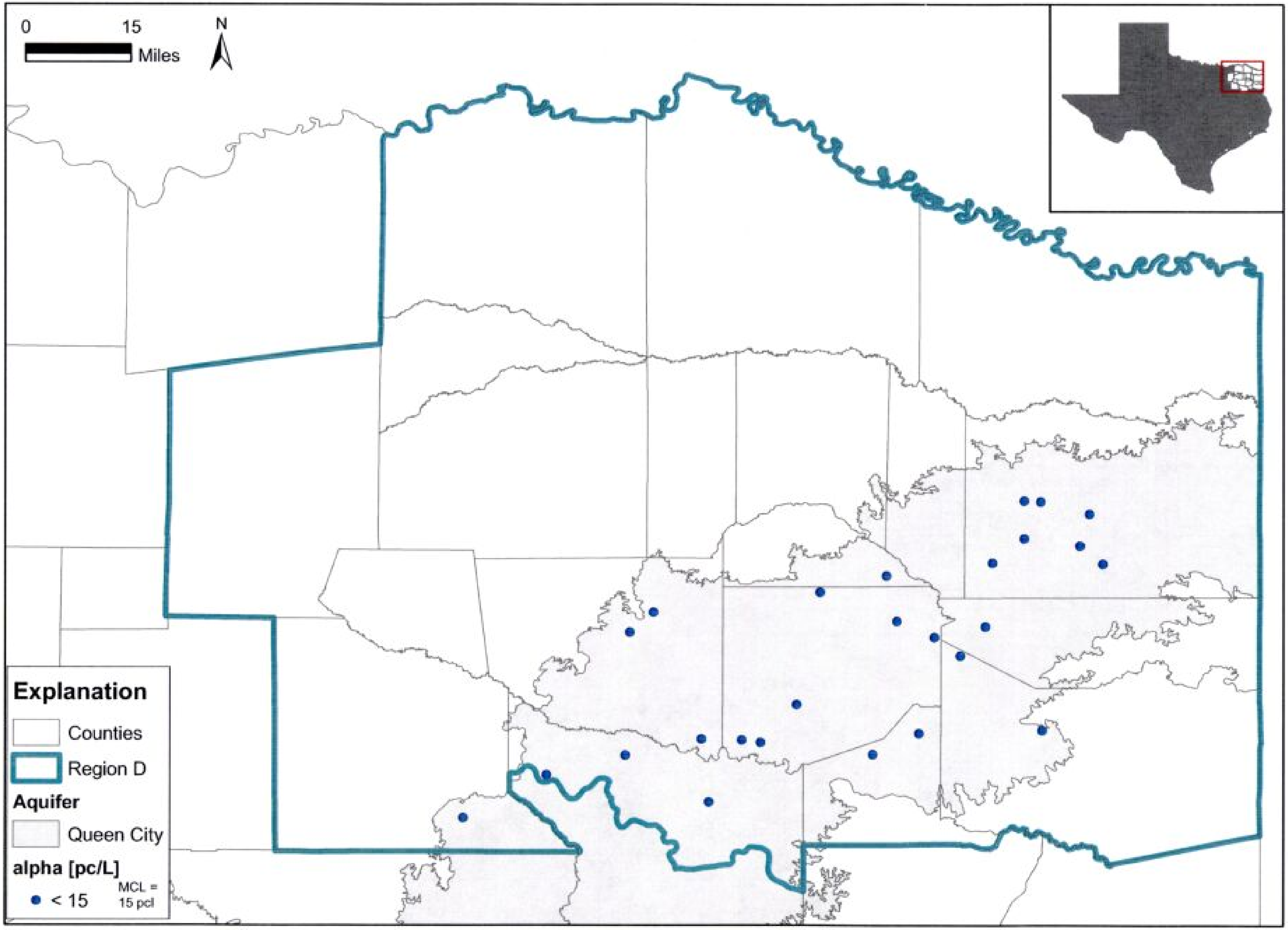
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.15



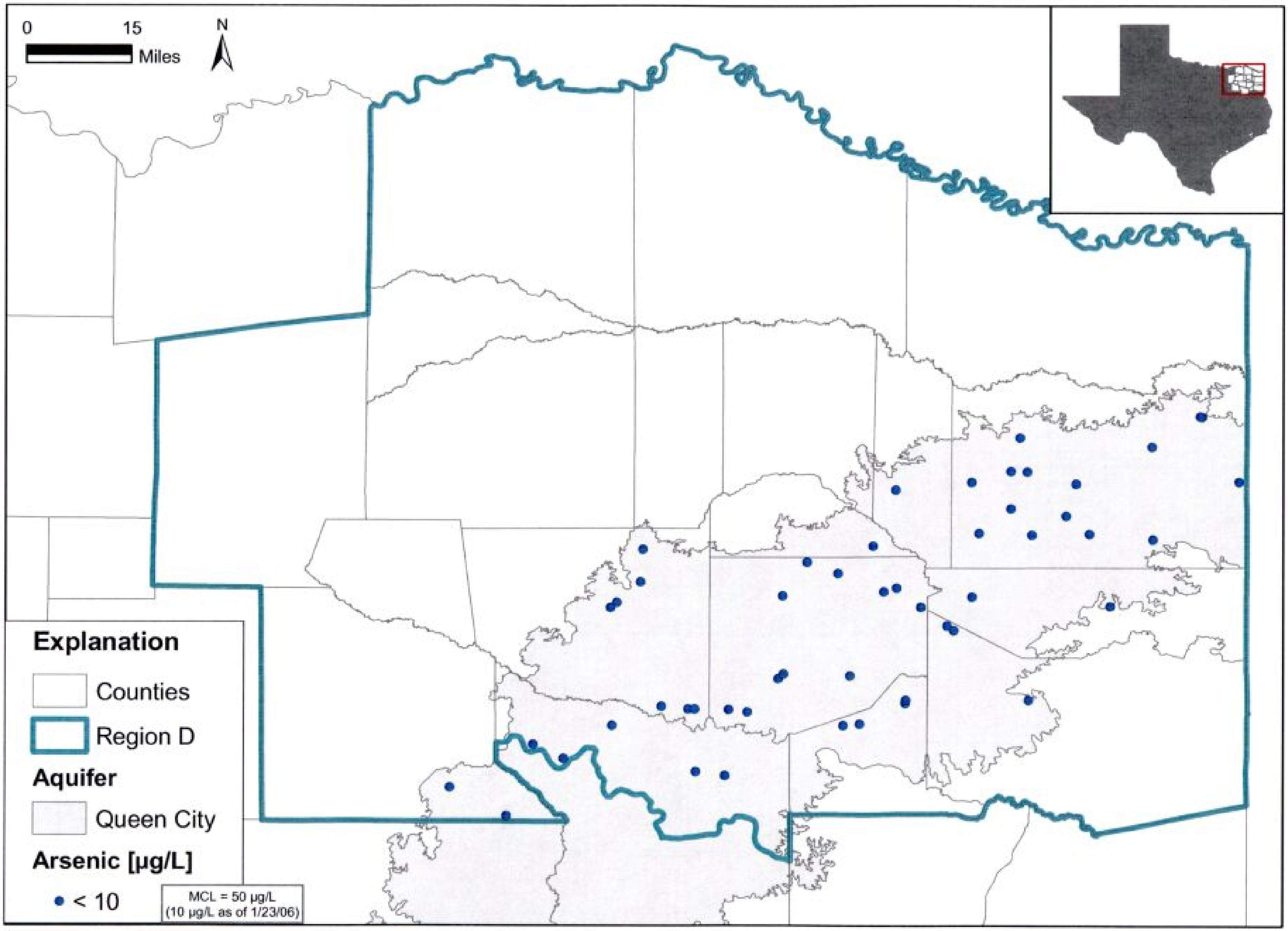
Water Quality in the Carrizo-Wilcox Aquifer

FIGURE A1.16



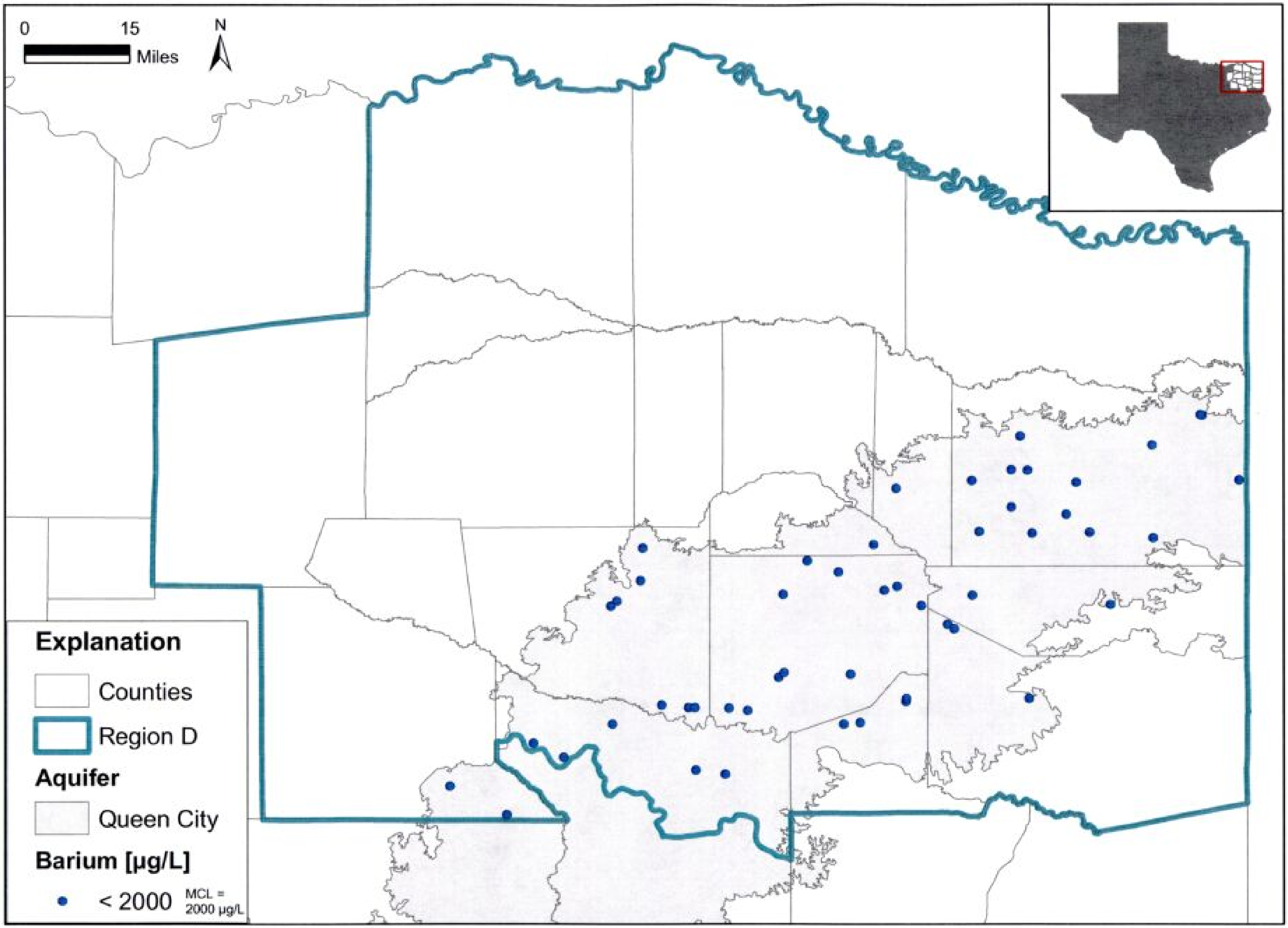
Water Quality in the Queen City Aquifer

FIGURE A1.17



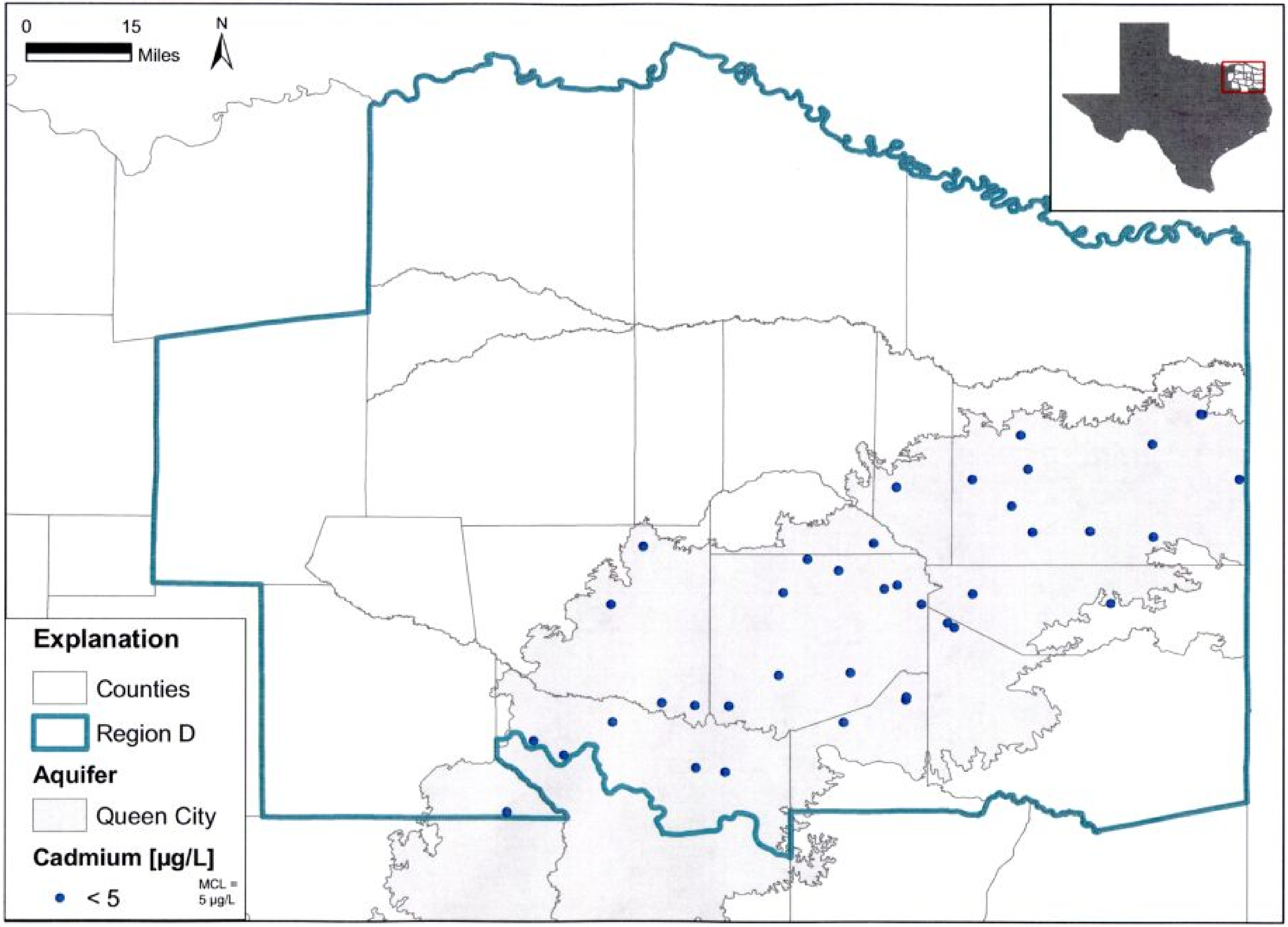
Water Quality in the Queen City Aquifer

FIGURE A1.18



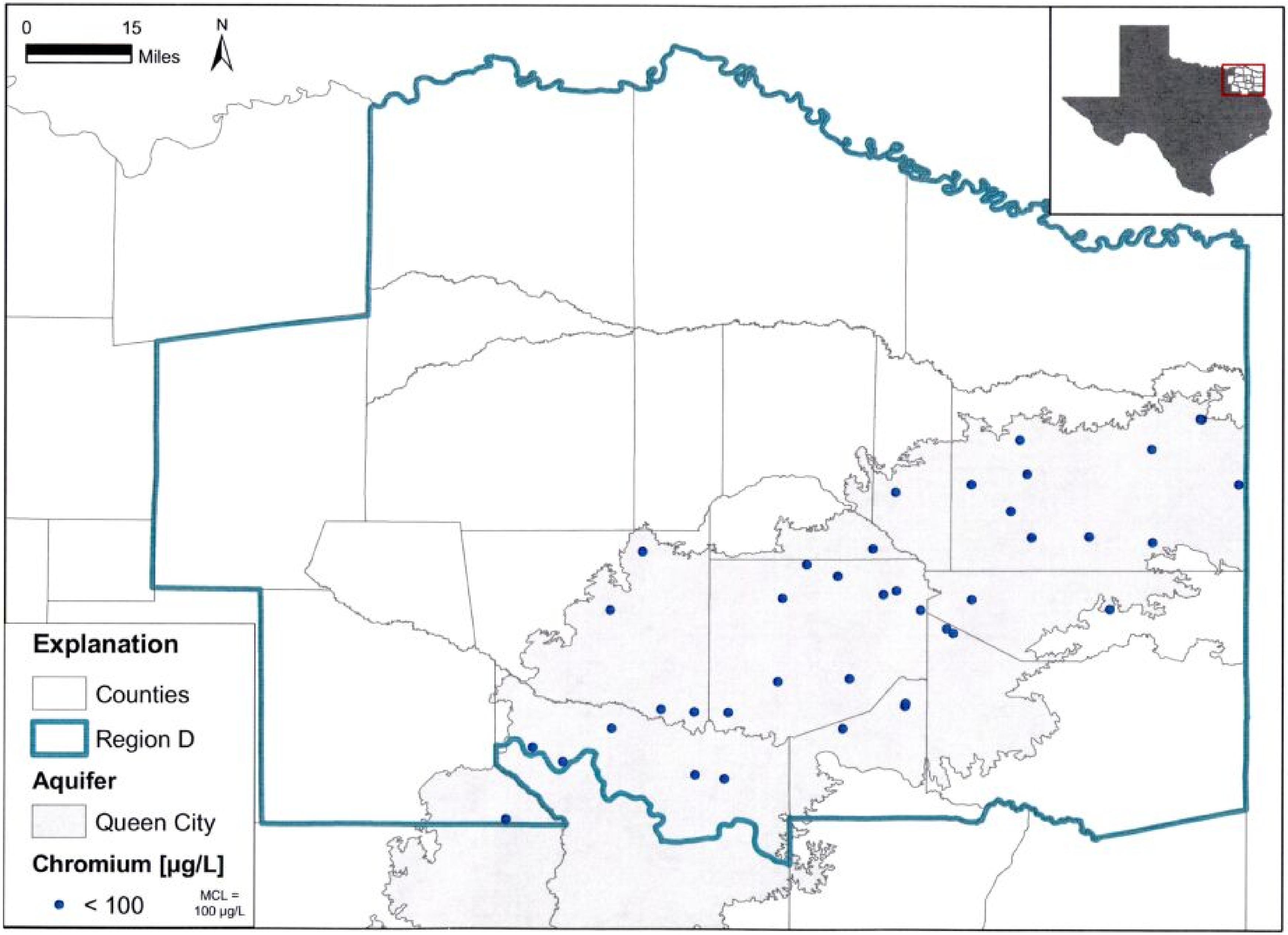
Water Quality in the Queen City Aquifer

FIGURE A1.19



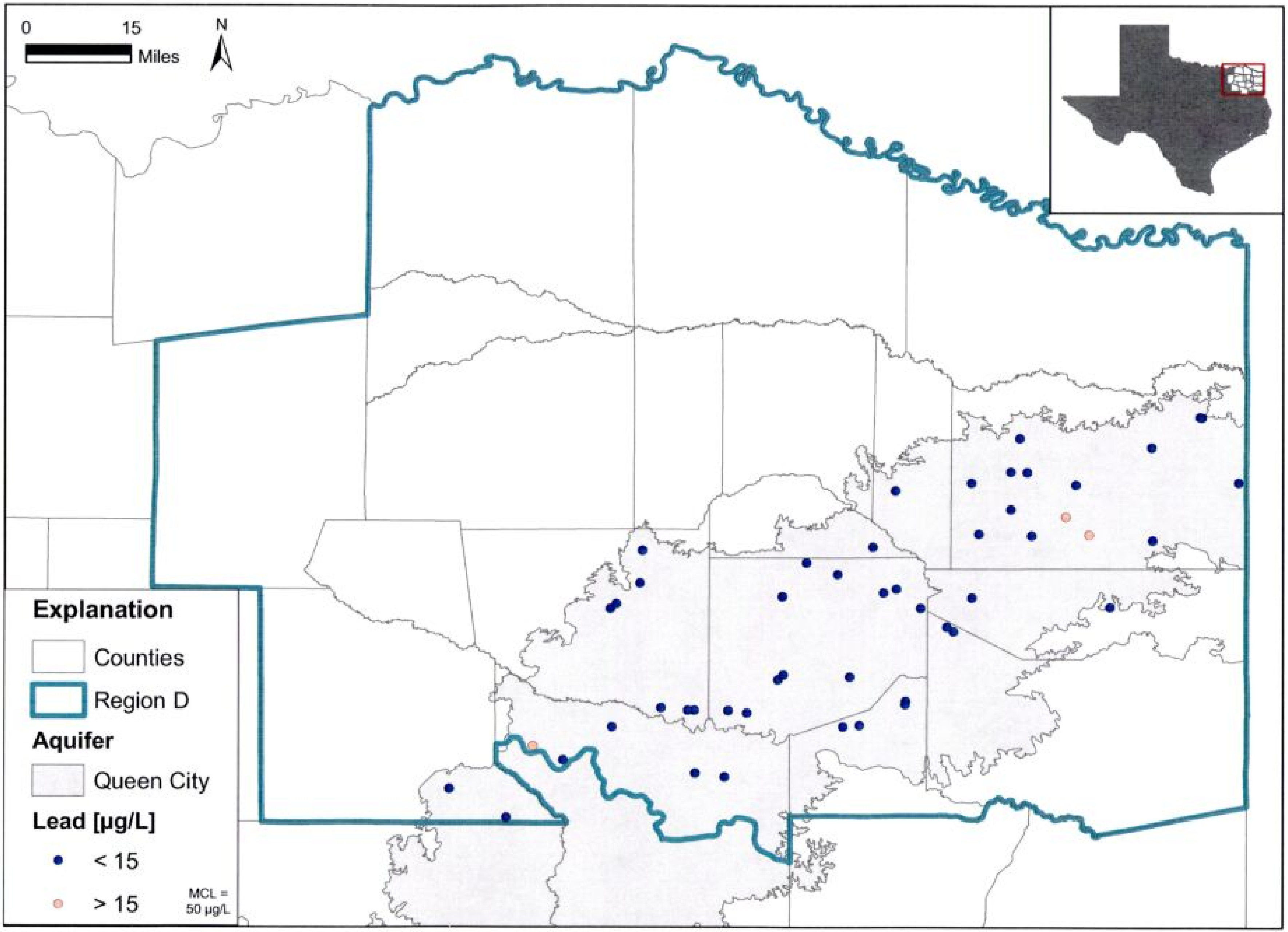
Water Quality in the Queen City Aquifer

FIGURE A1.20



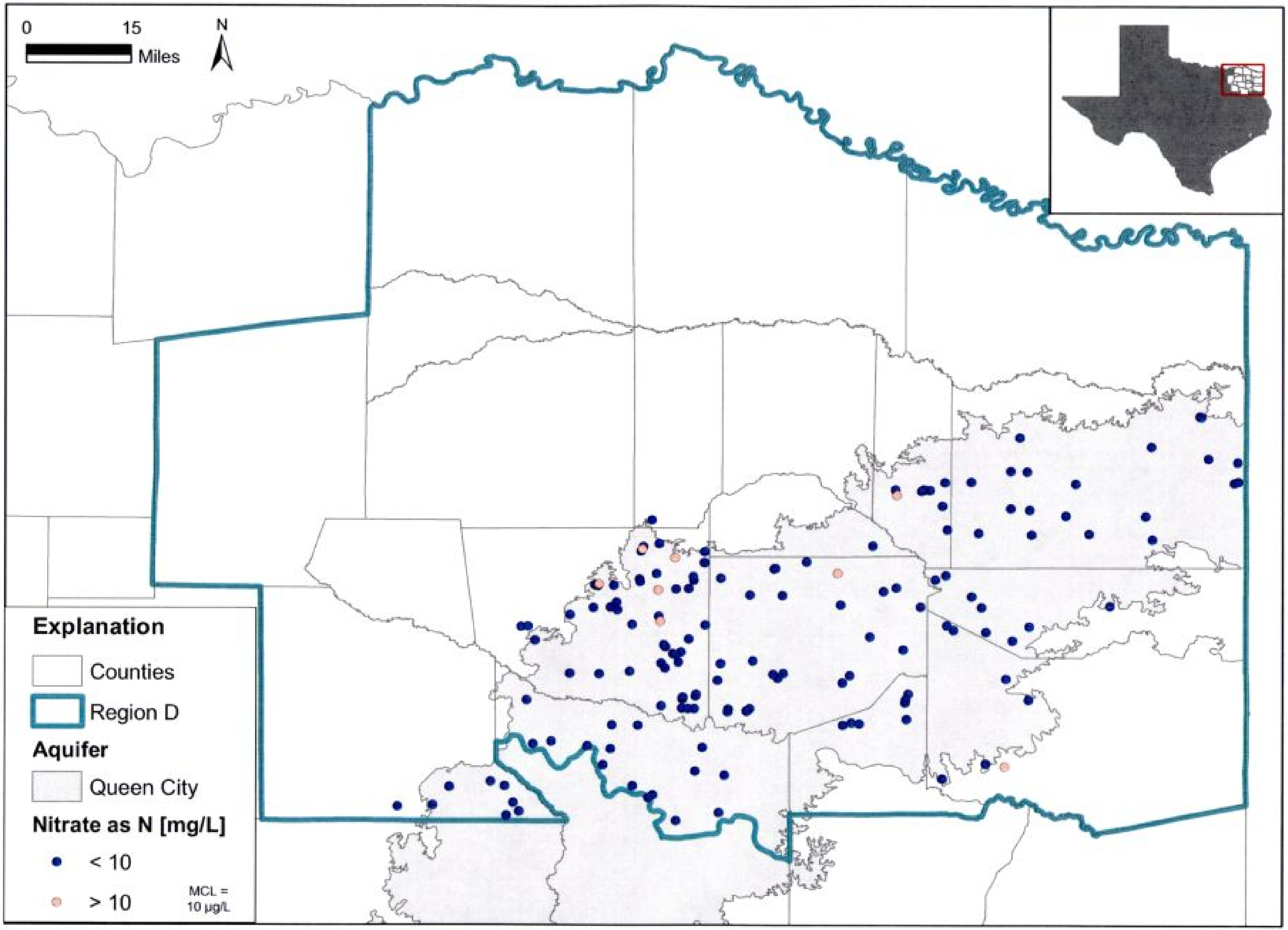
Water Quality in the Queen City Aquifer

FIGURE A1.21



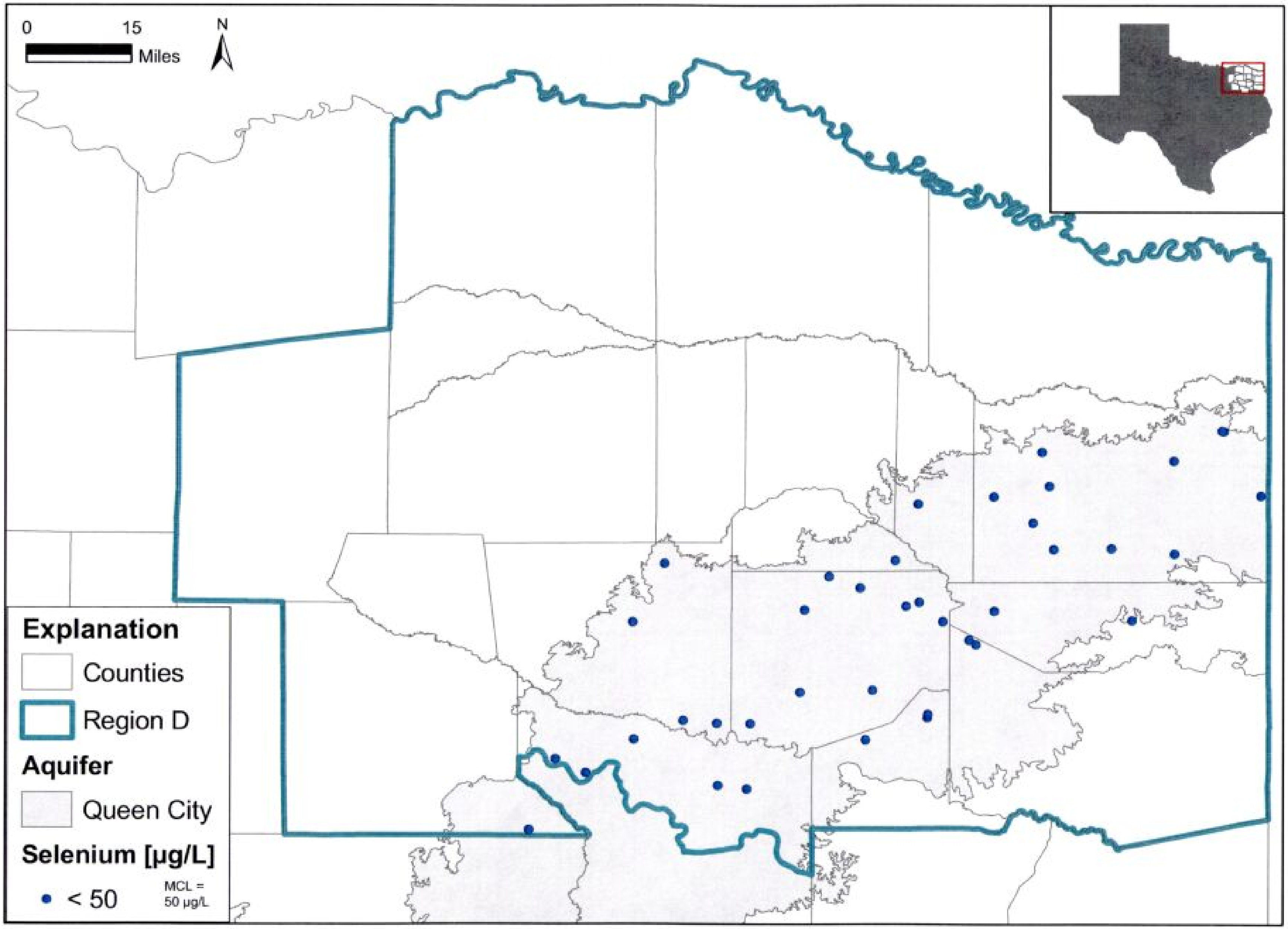
Water Quality in the Queen City Aquifer

FIGURE A1.22



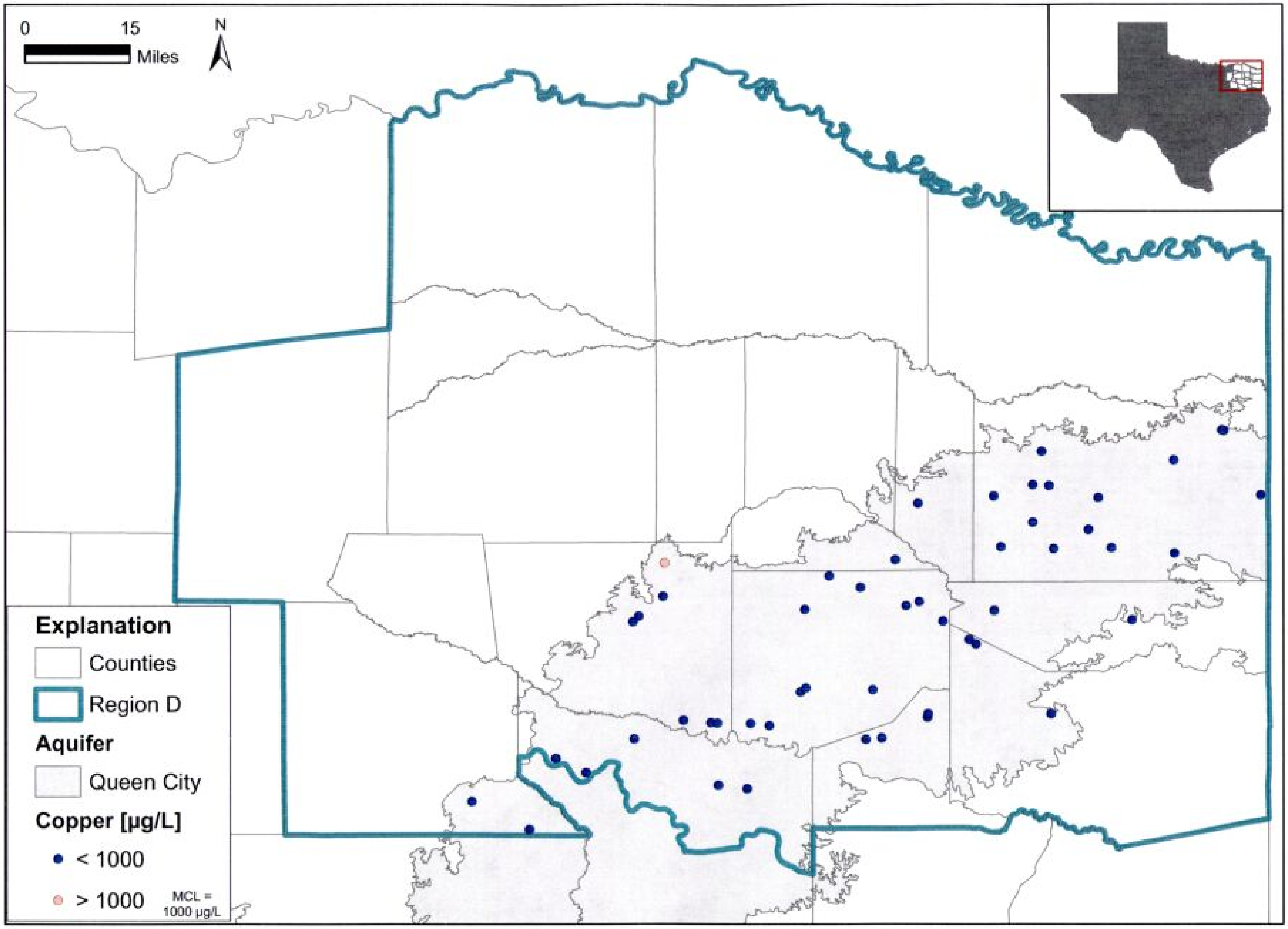
Water Quality in the Queen City Aquifer

FIGURE A1.23



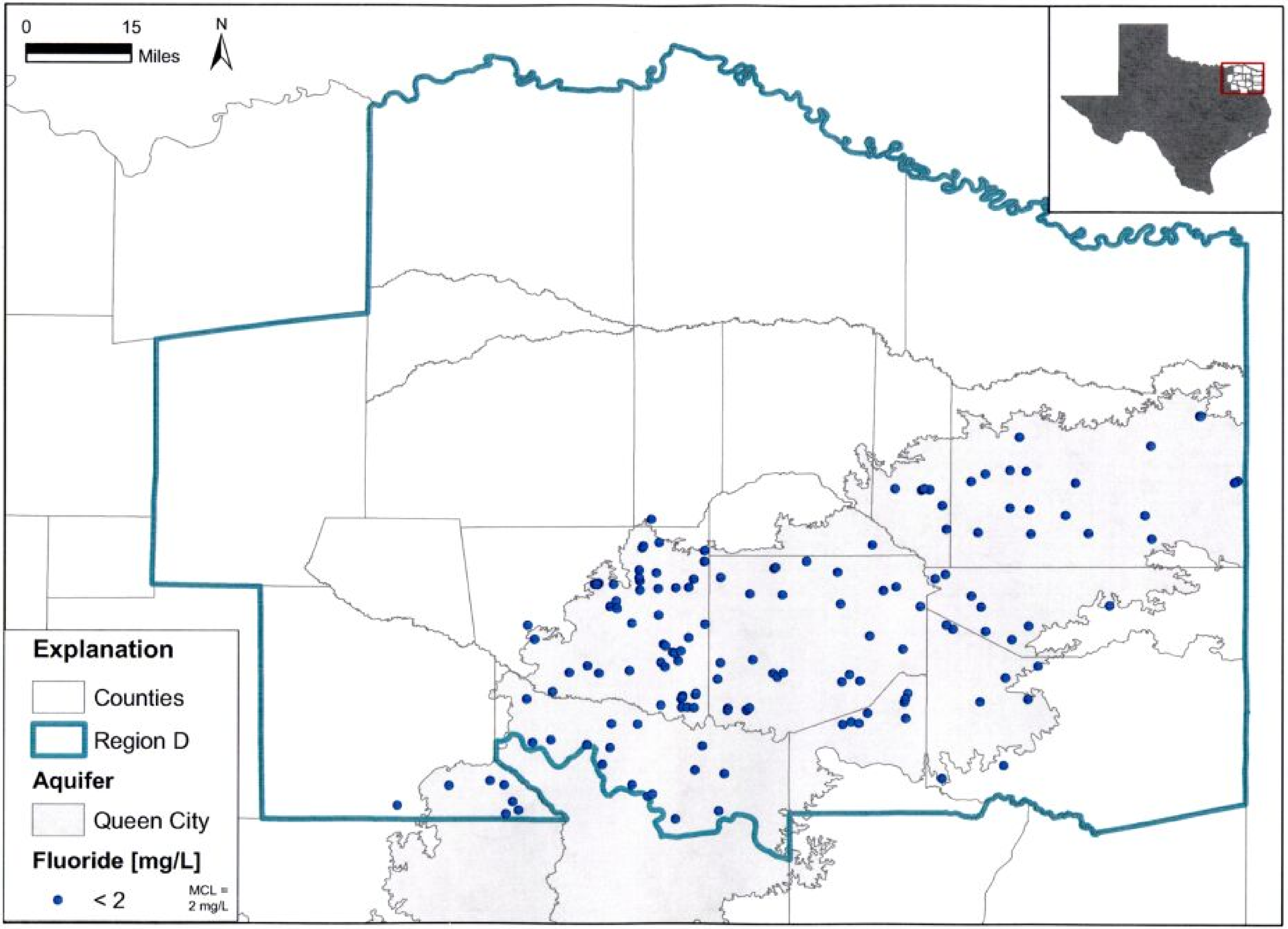
Water Quality in the Queen City Aquifer

FIGURE A1.24



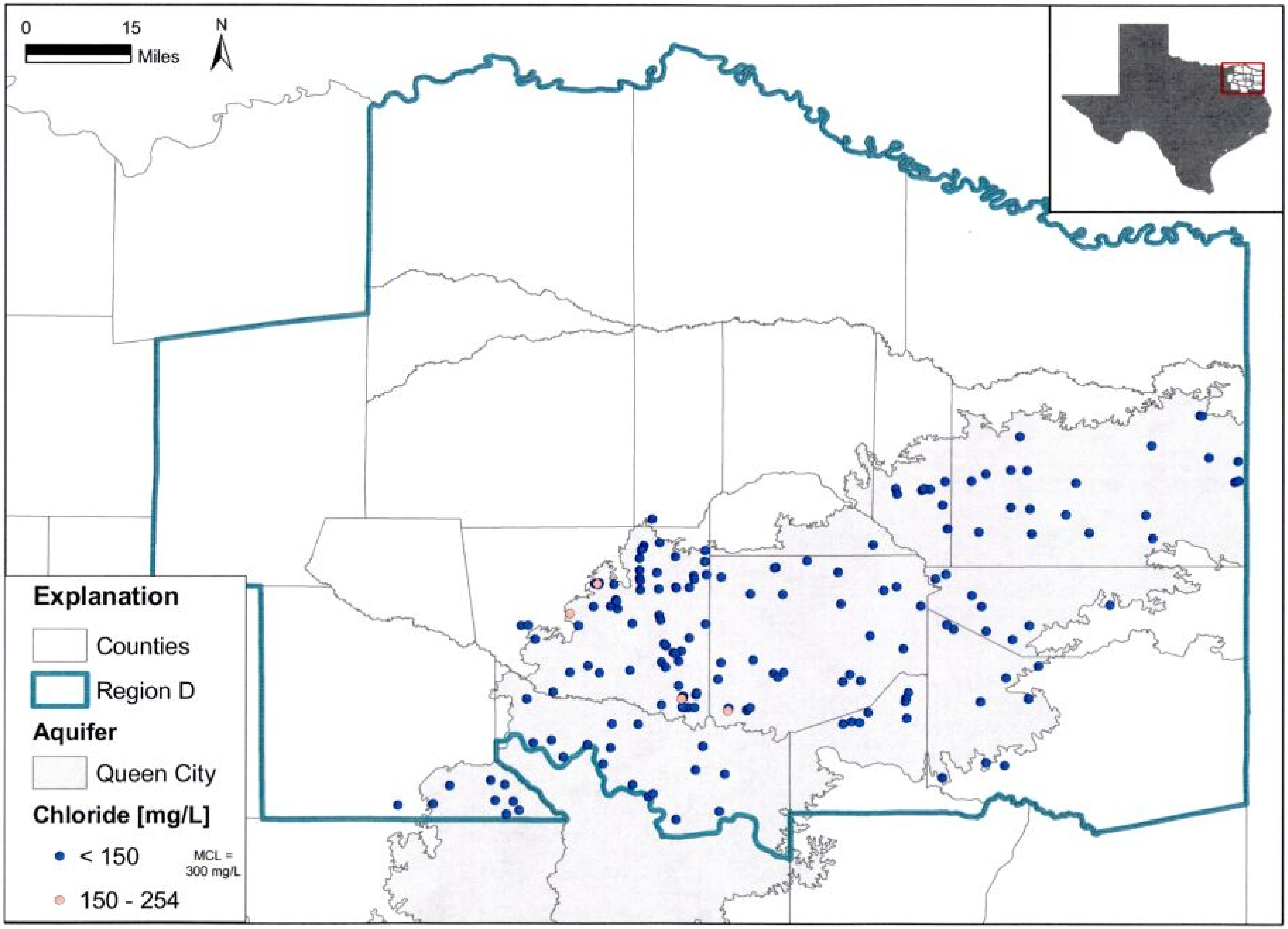
Water Quality in the Queen City Aquifer

FIGURE A1.25



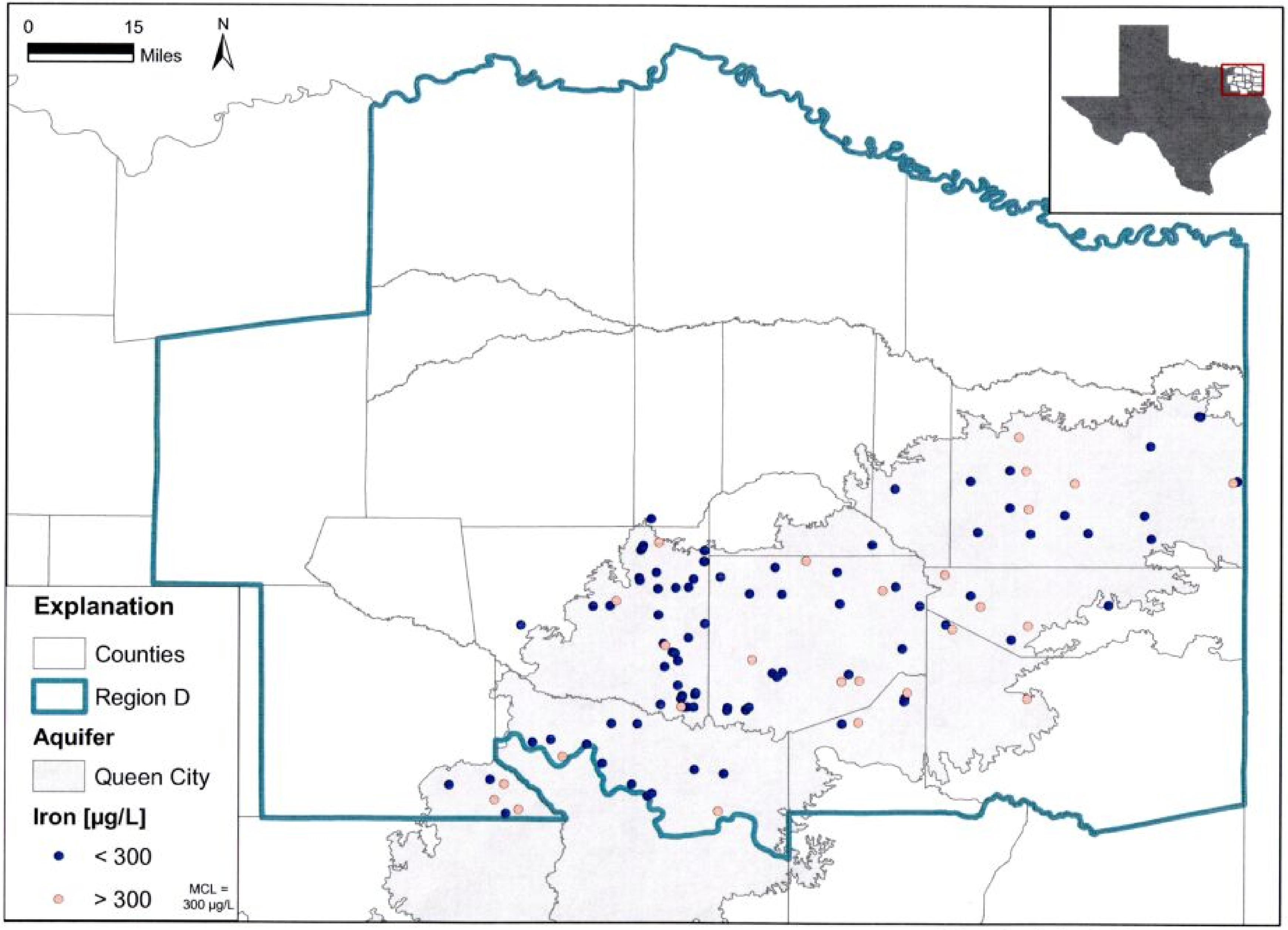
Water Quality in the Queen City Aquifer

FIGURE A1.26



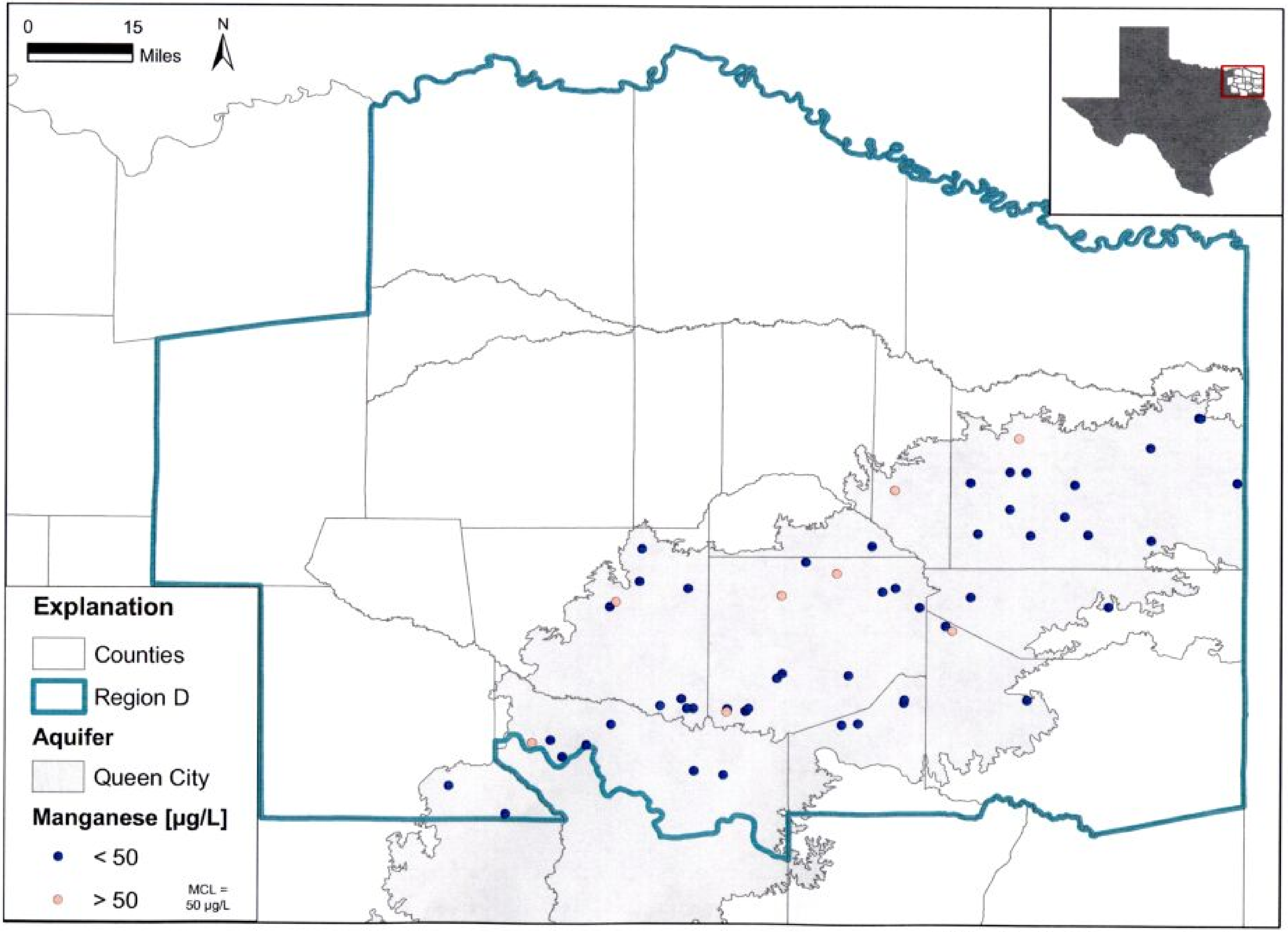
Water Quality in the Queen City Aquifer

FIGURE A1.27



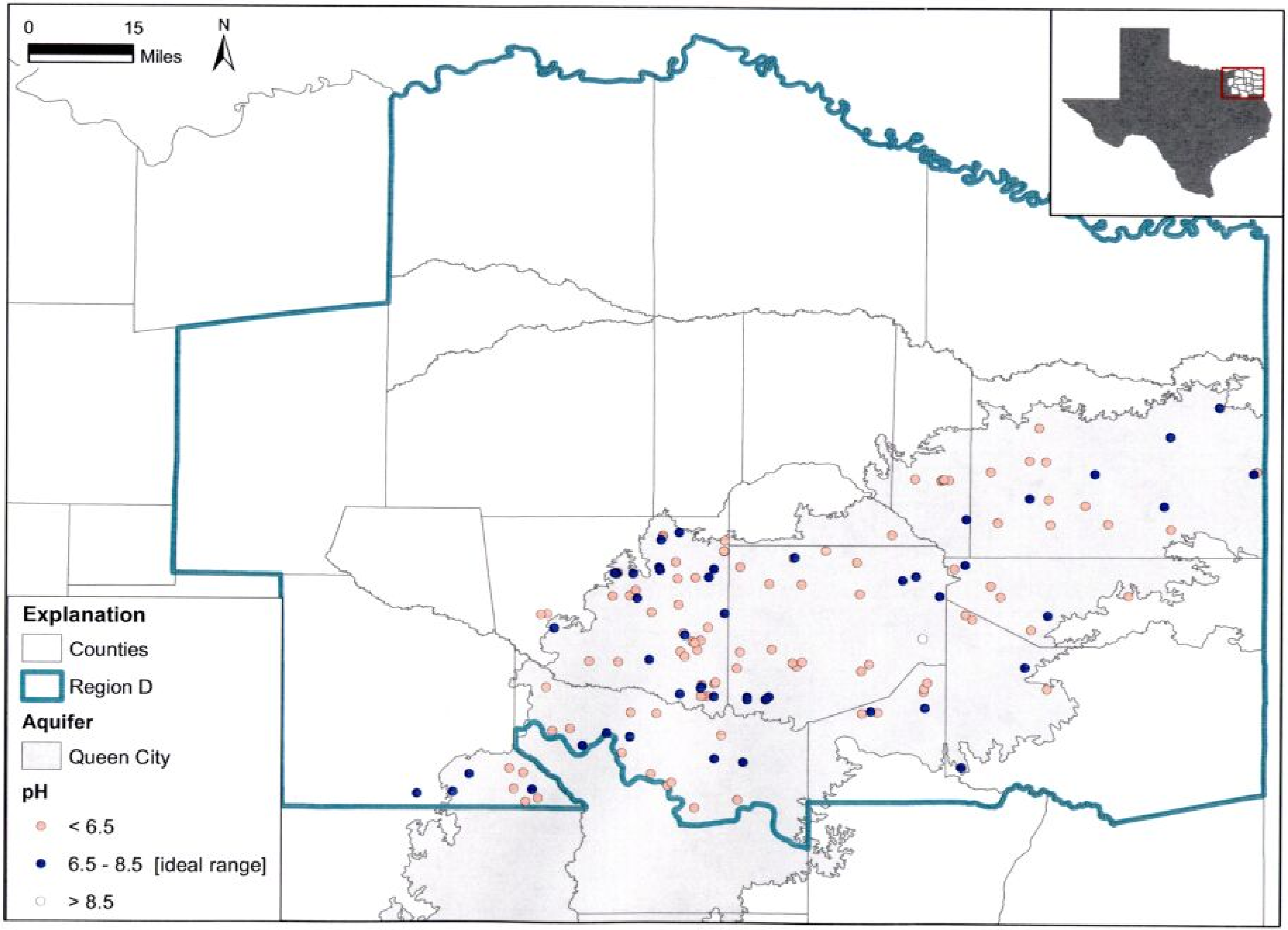
Water Quality in the Queen City Aquifer

FIGURE A1.28



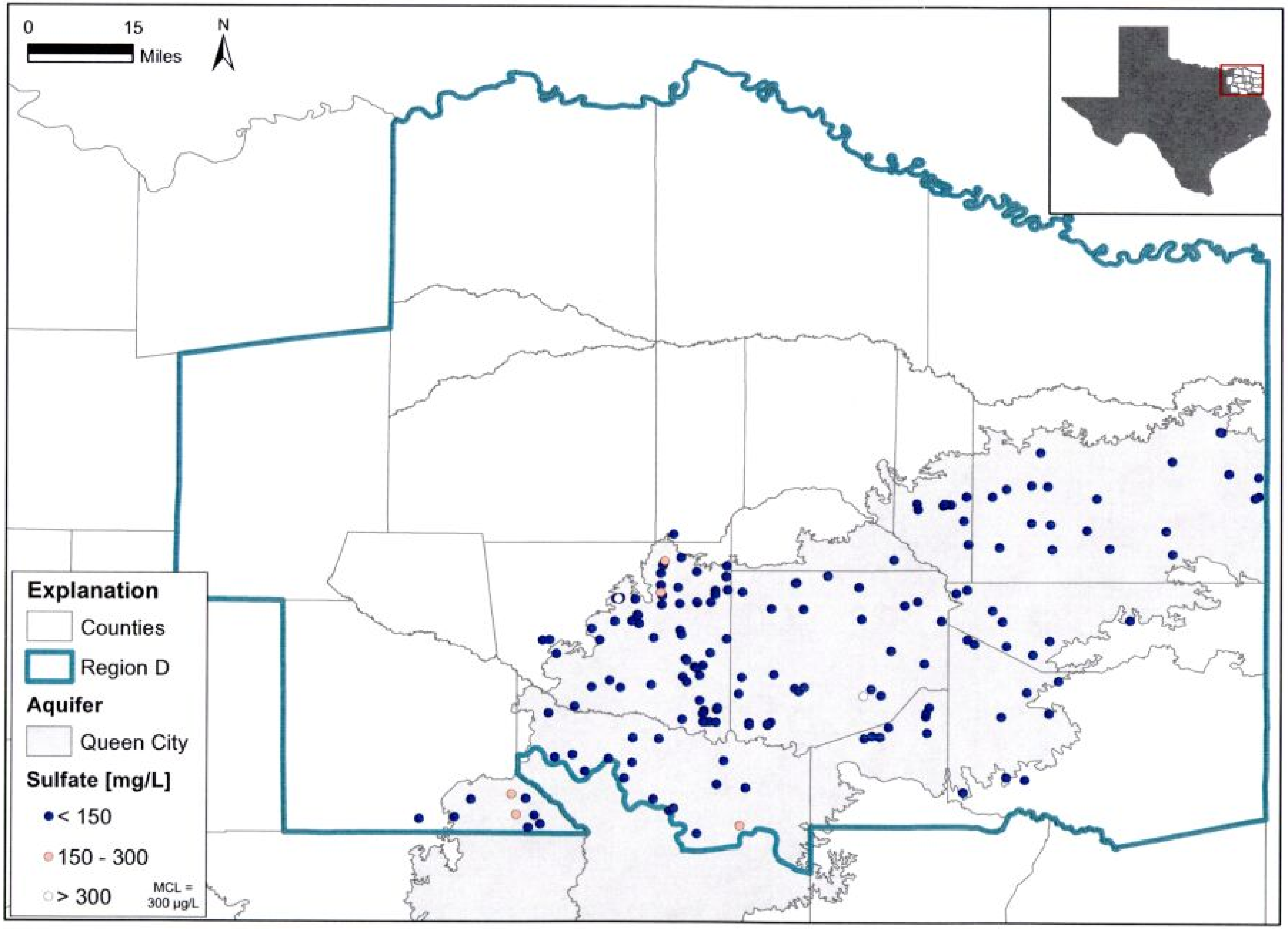
Water Quality in the Queen City Aquifer

FIGURE A1.29



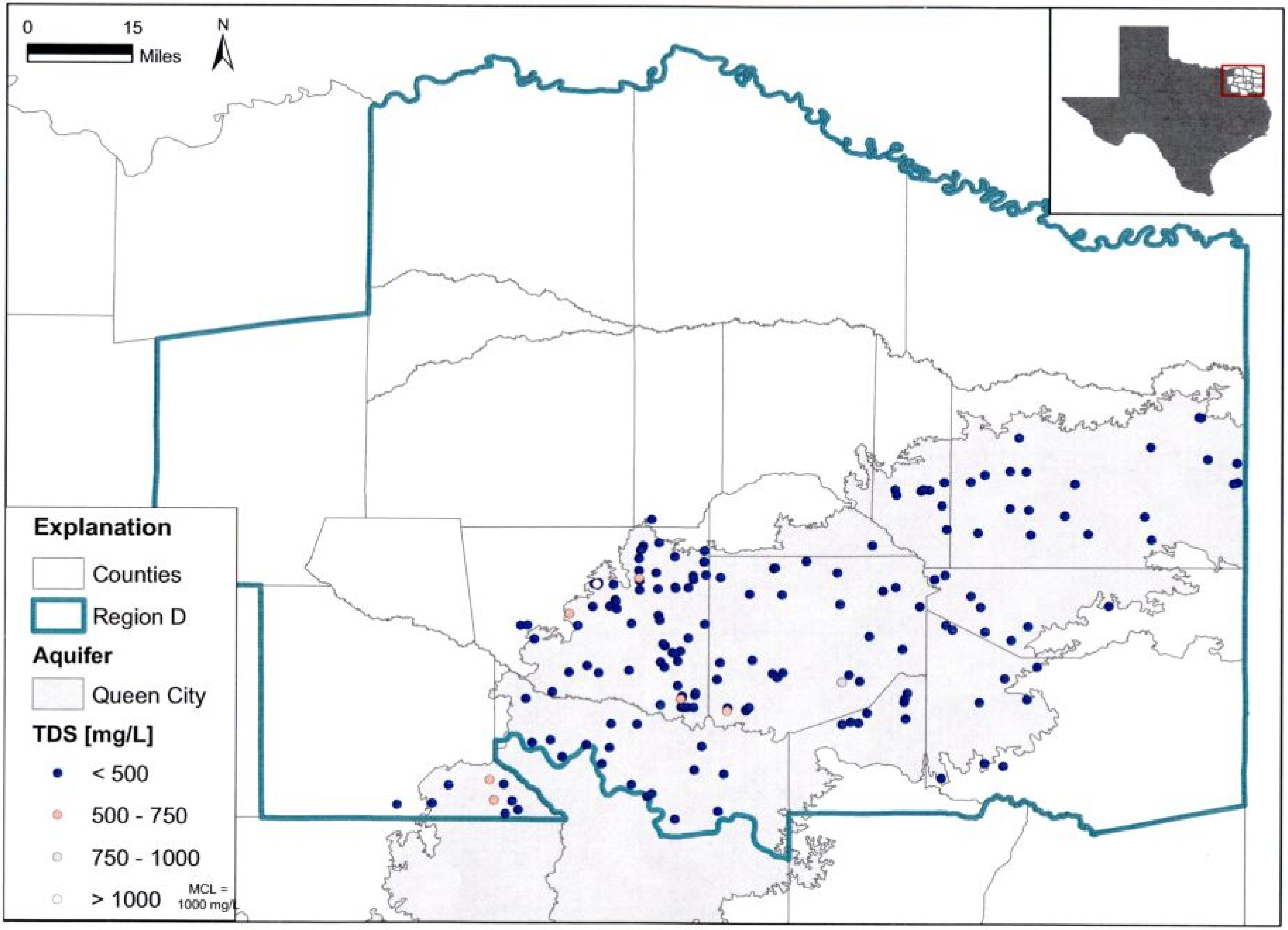
Water Quality in the Queen City Aquifer

FIGURE A1.30



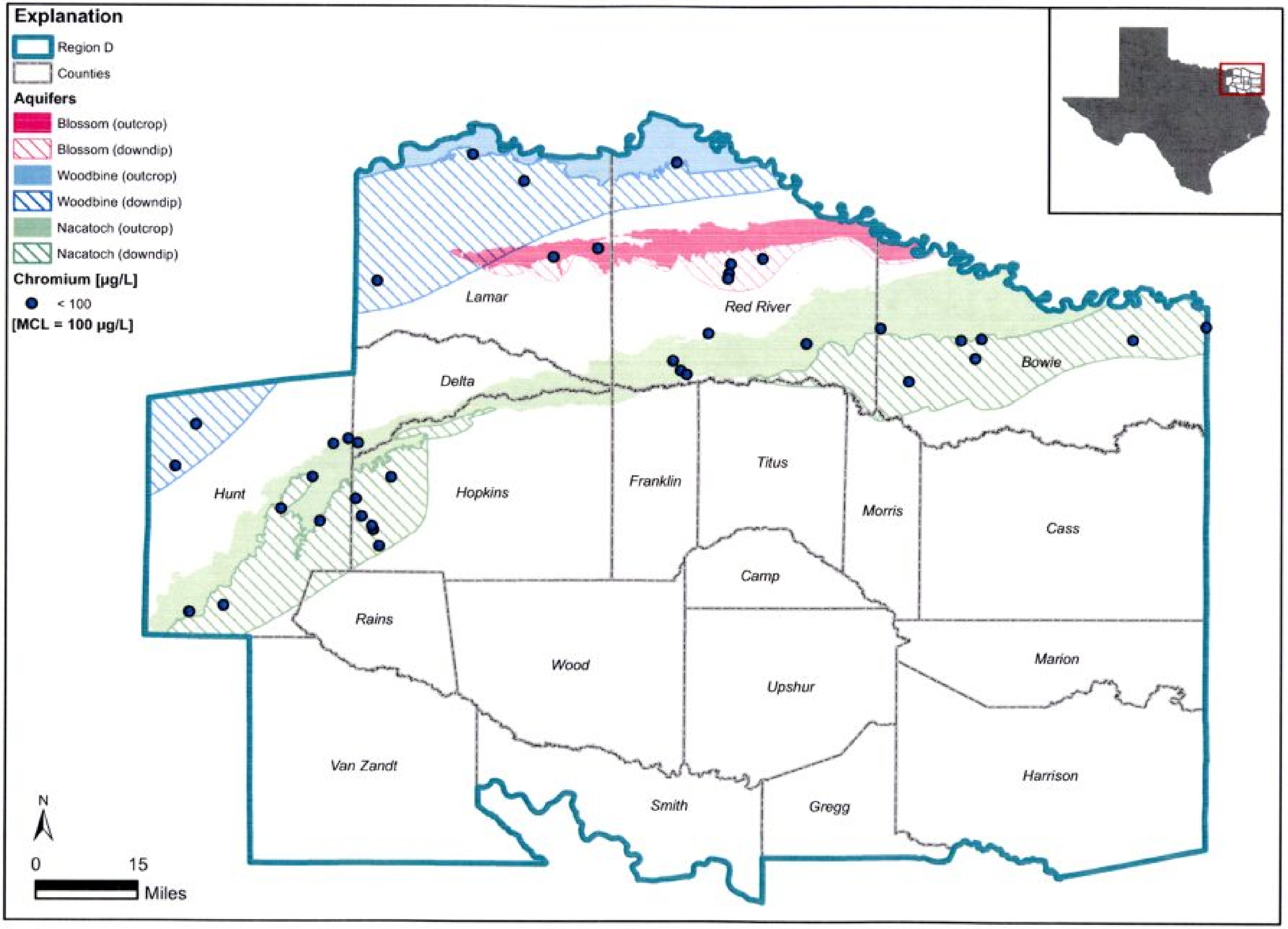
Water Quality in the Queen City Aquifer

FIGURE A1.31



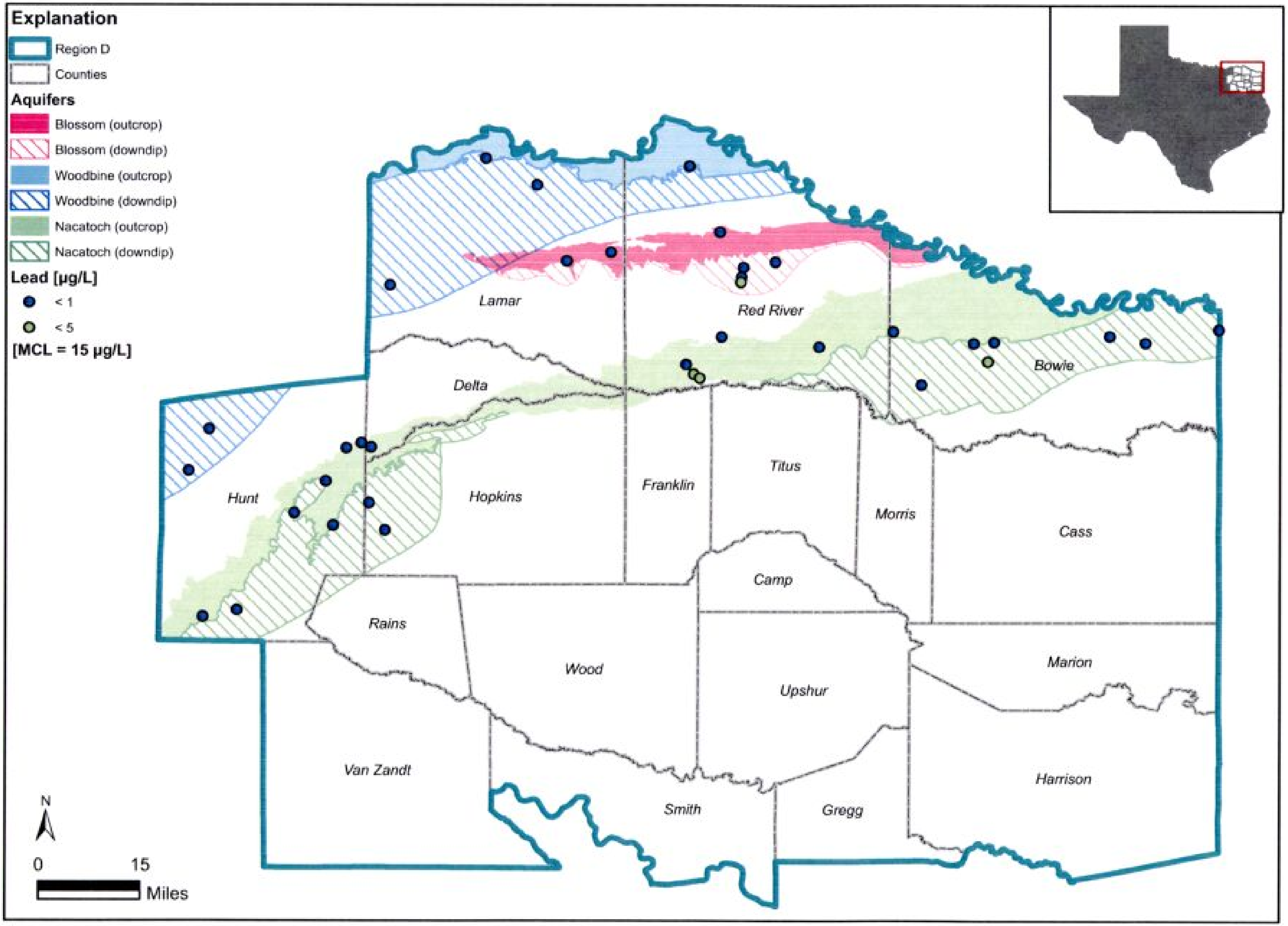
Water Quality in the Queen City Aquifer

FIGURE A1.32



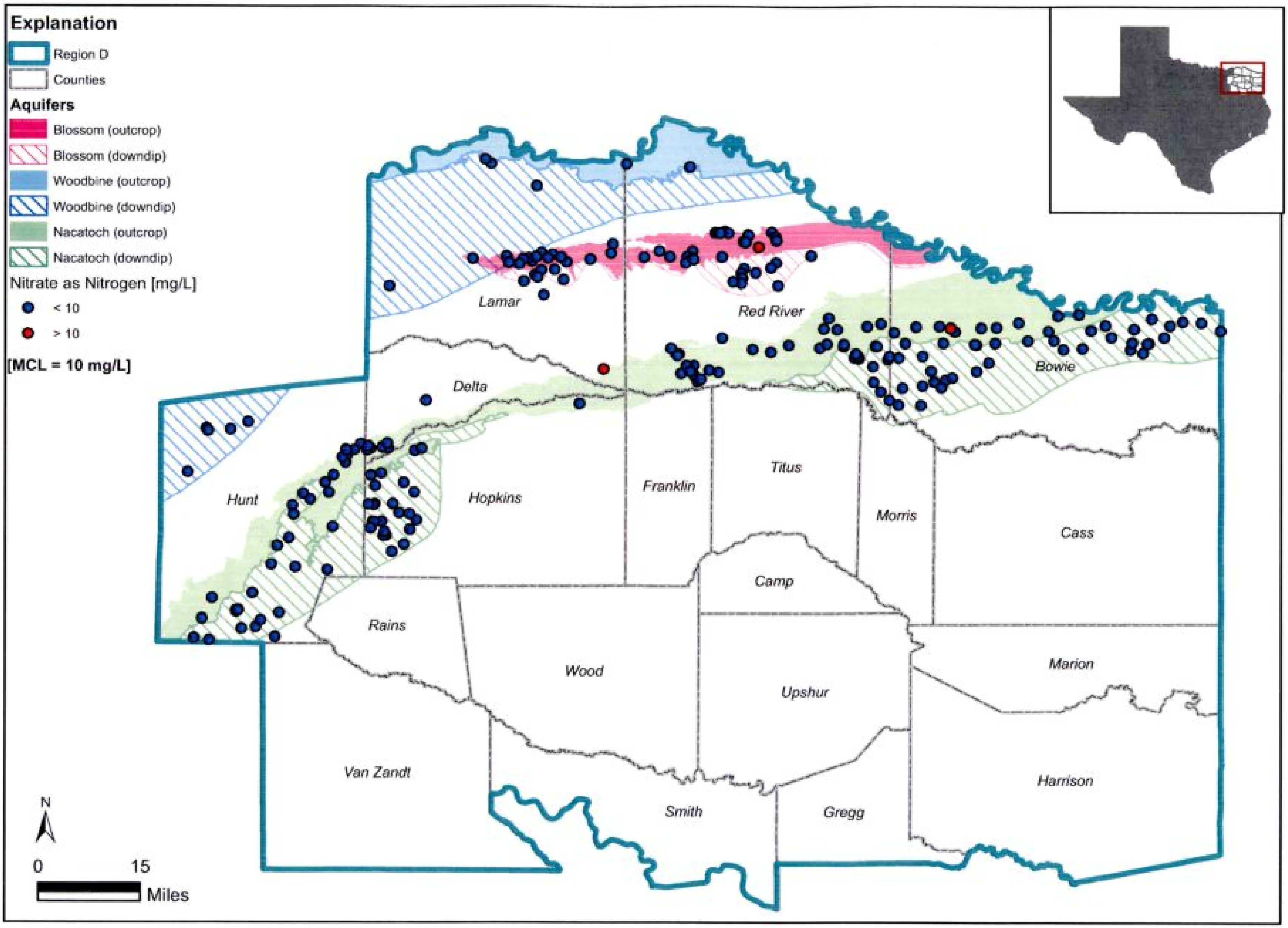
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.33



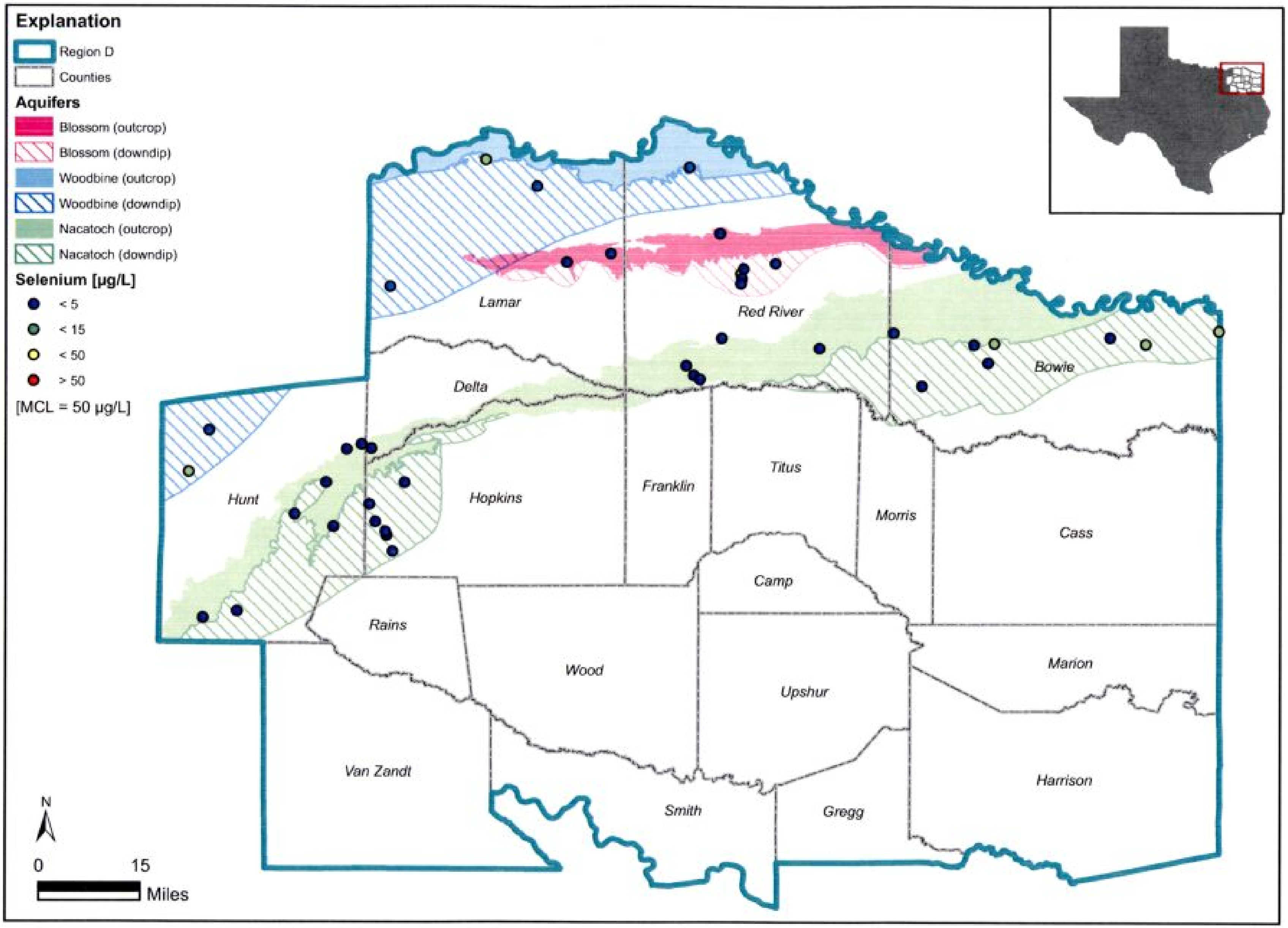
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.34



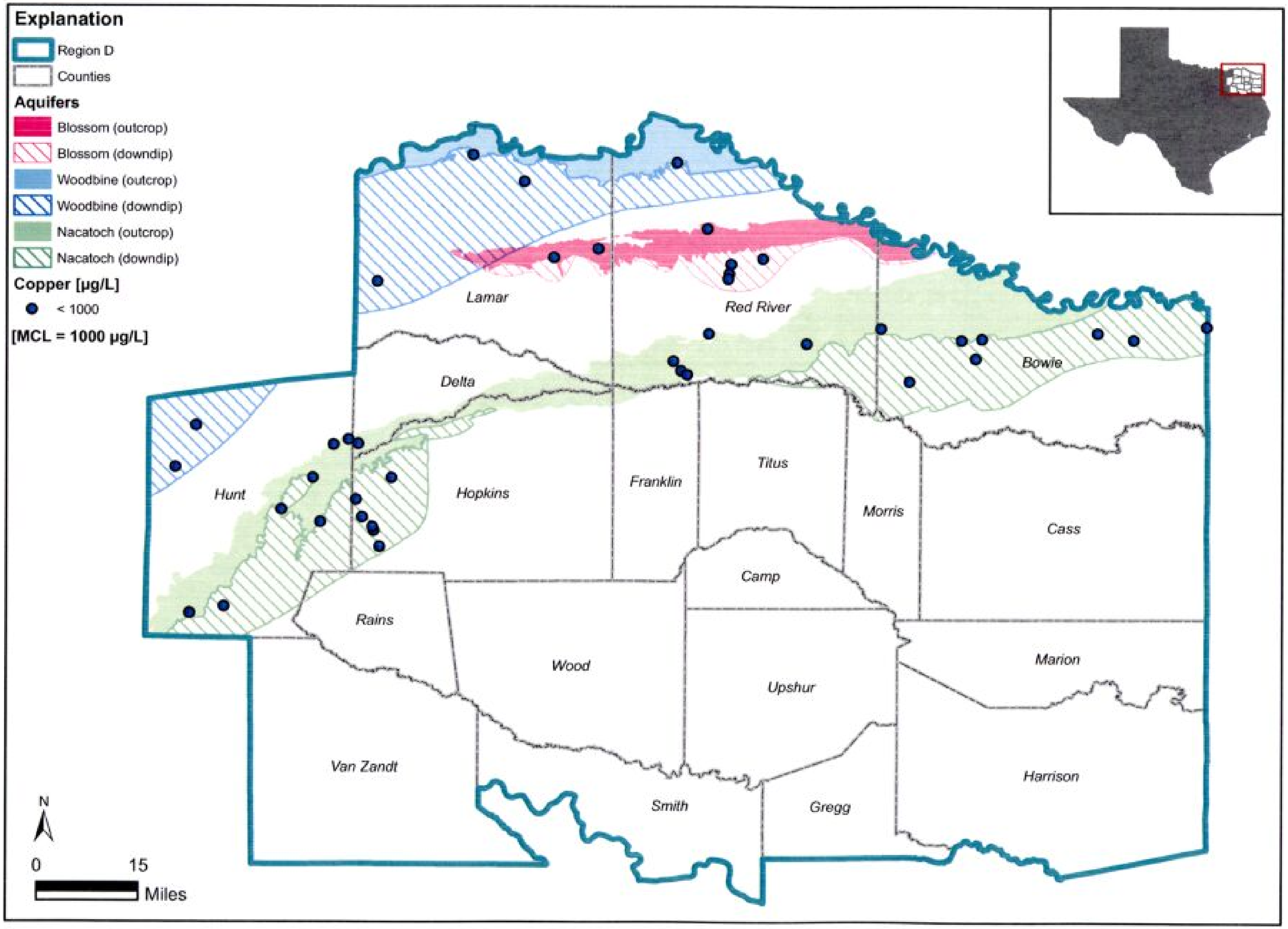
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.35



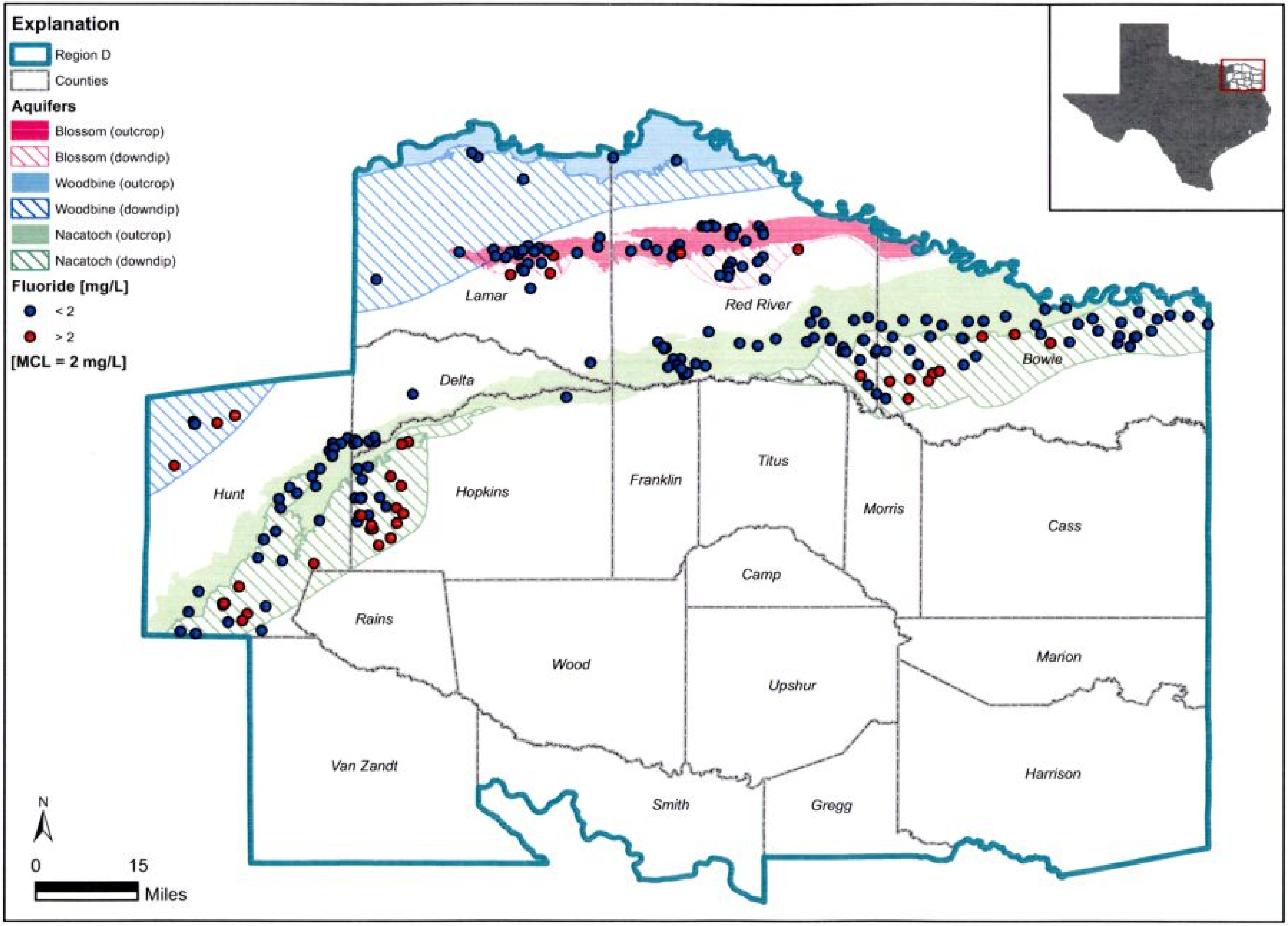
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.36



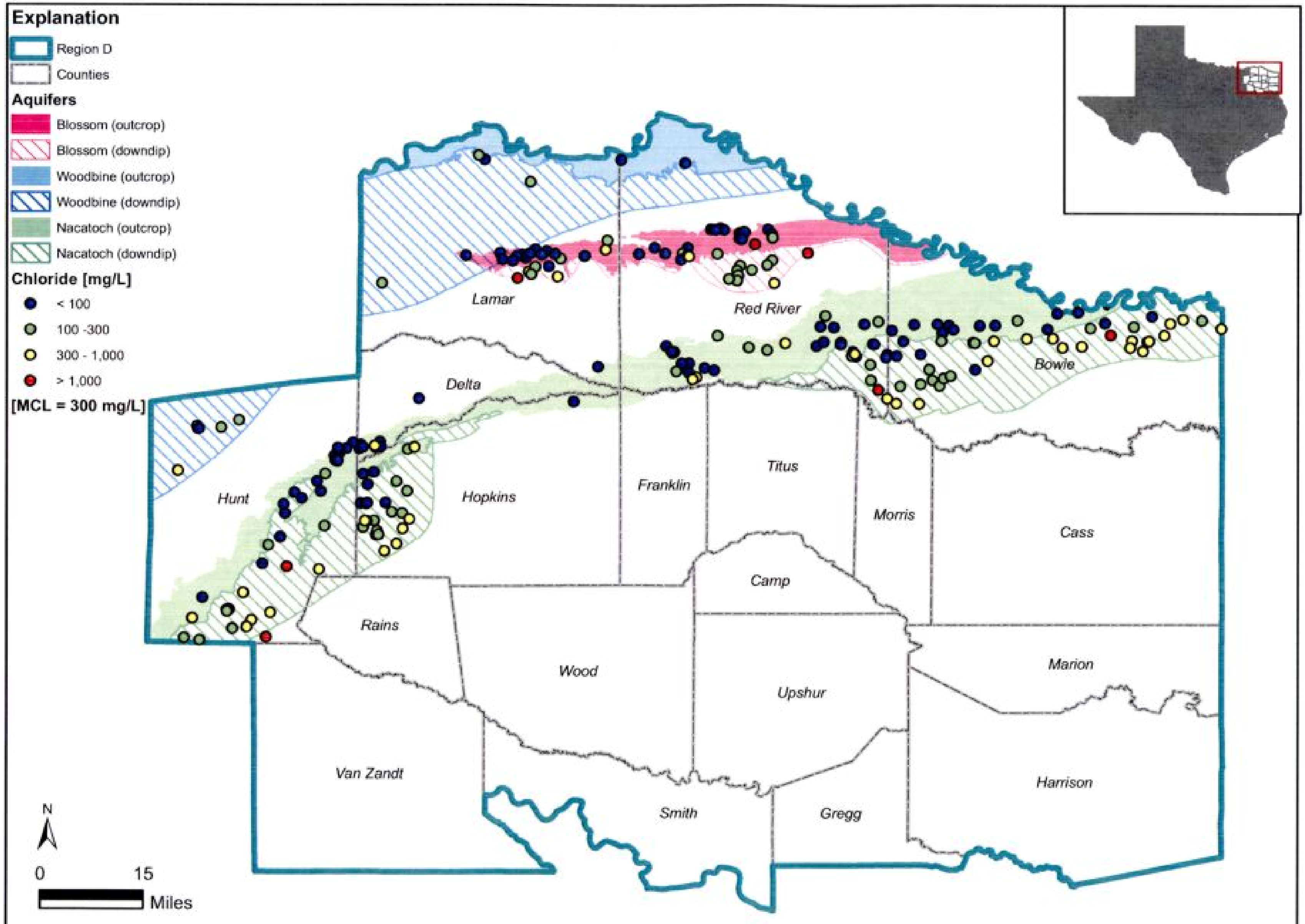
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.37



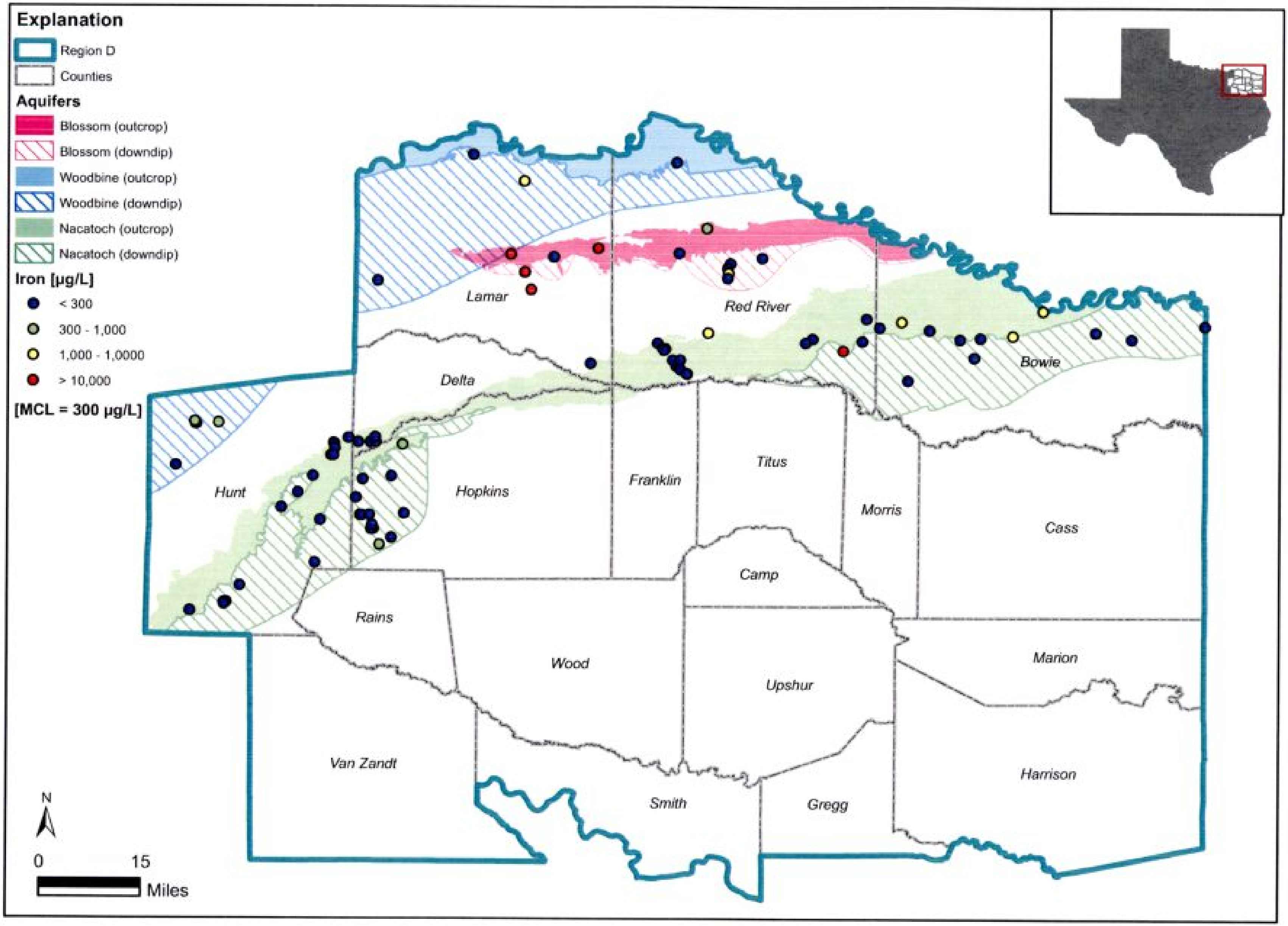
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.38



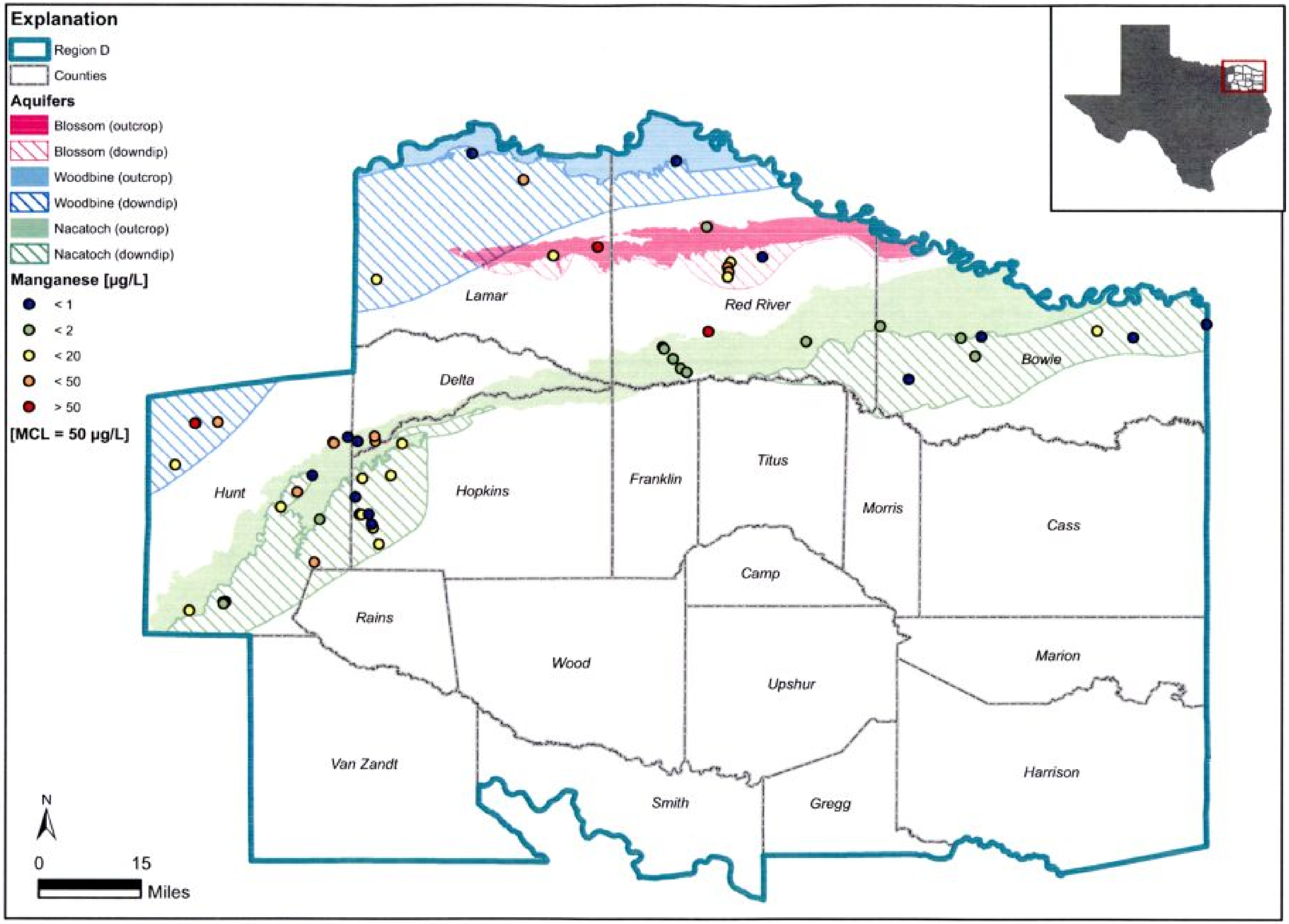
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.39



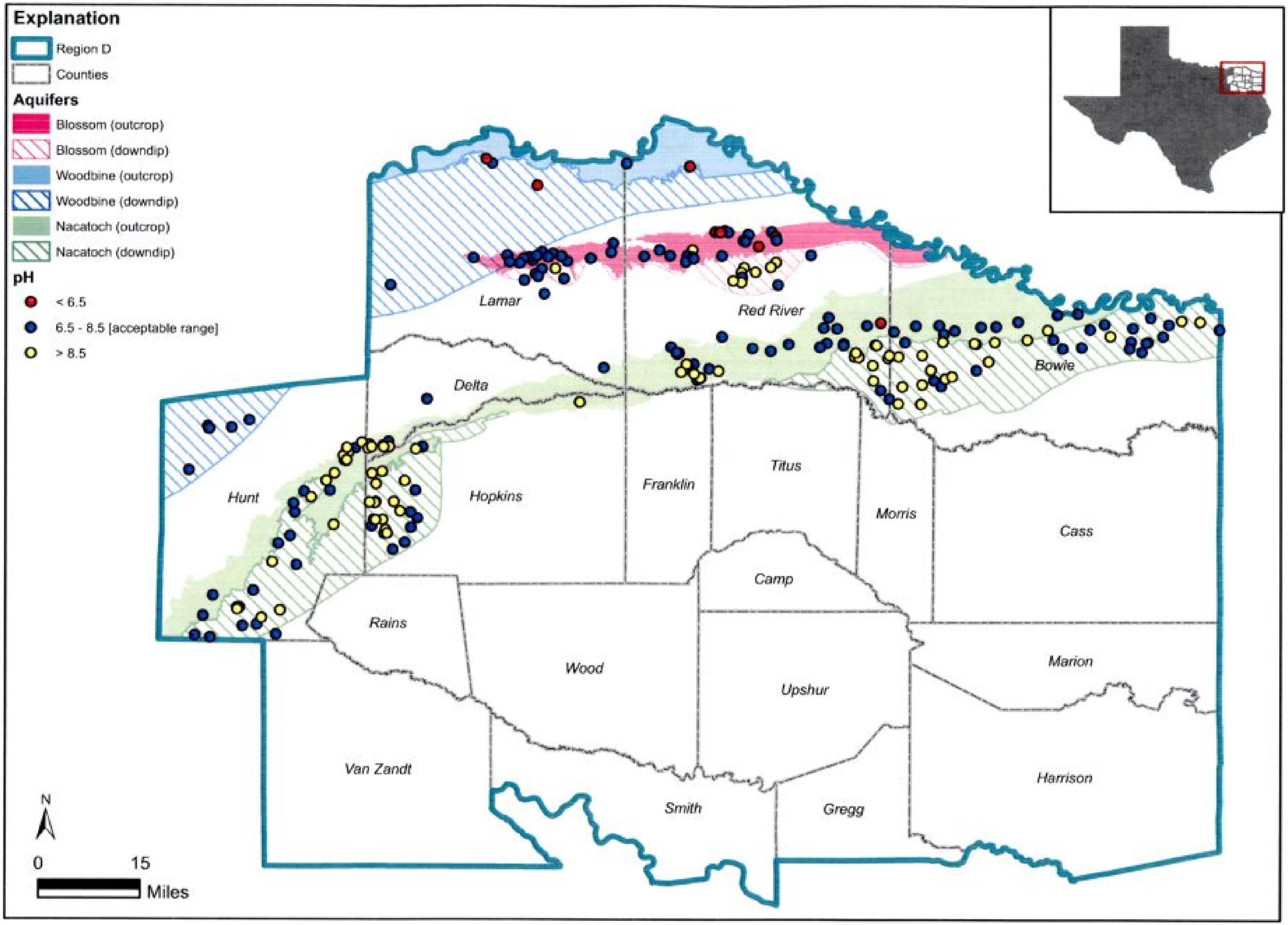
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.40



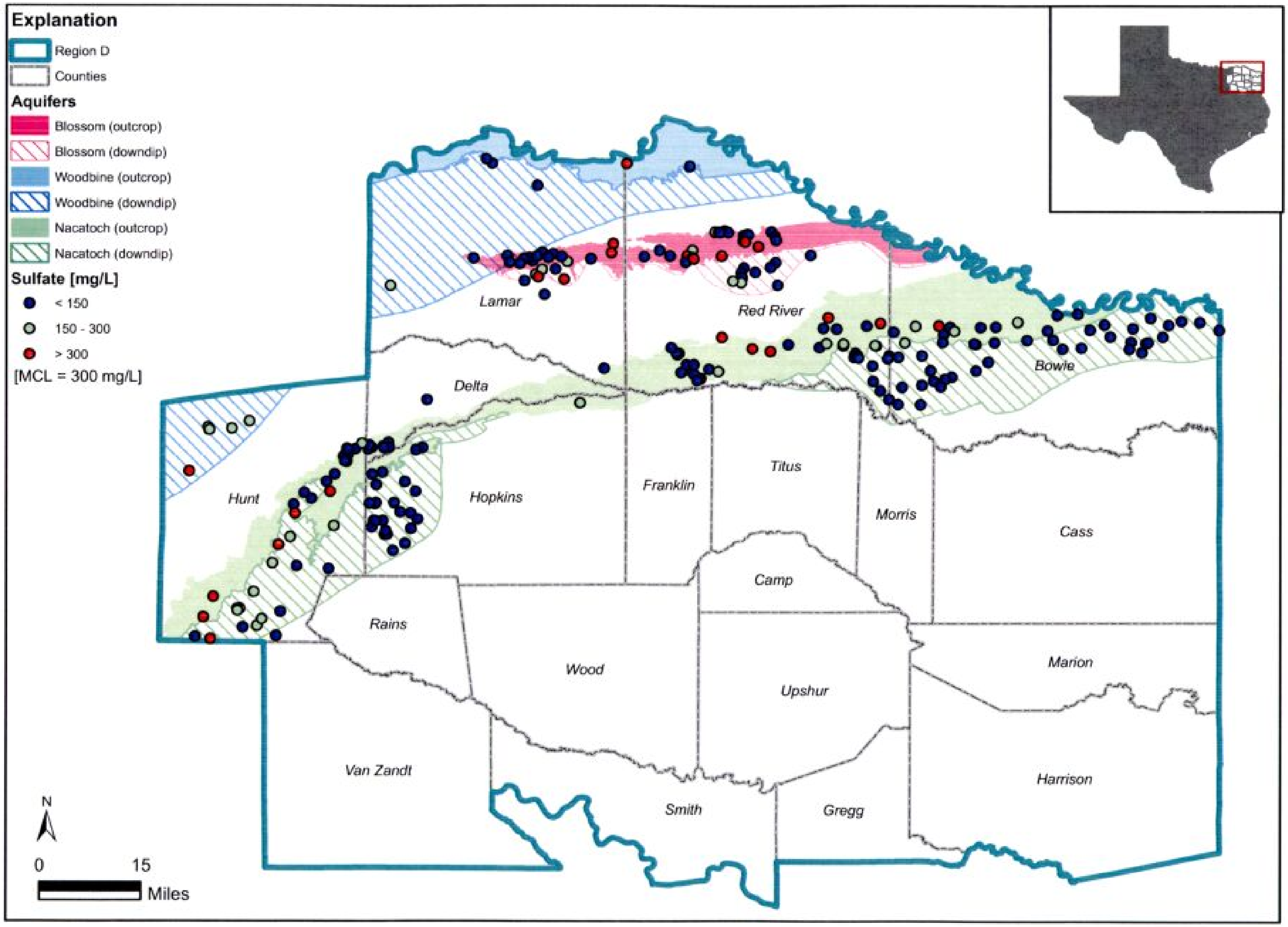
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.41



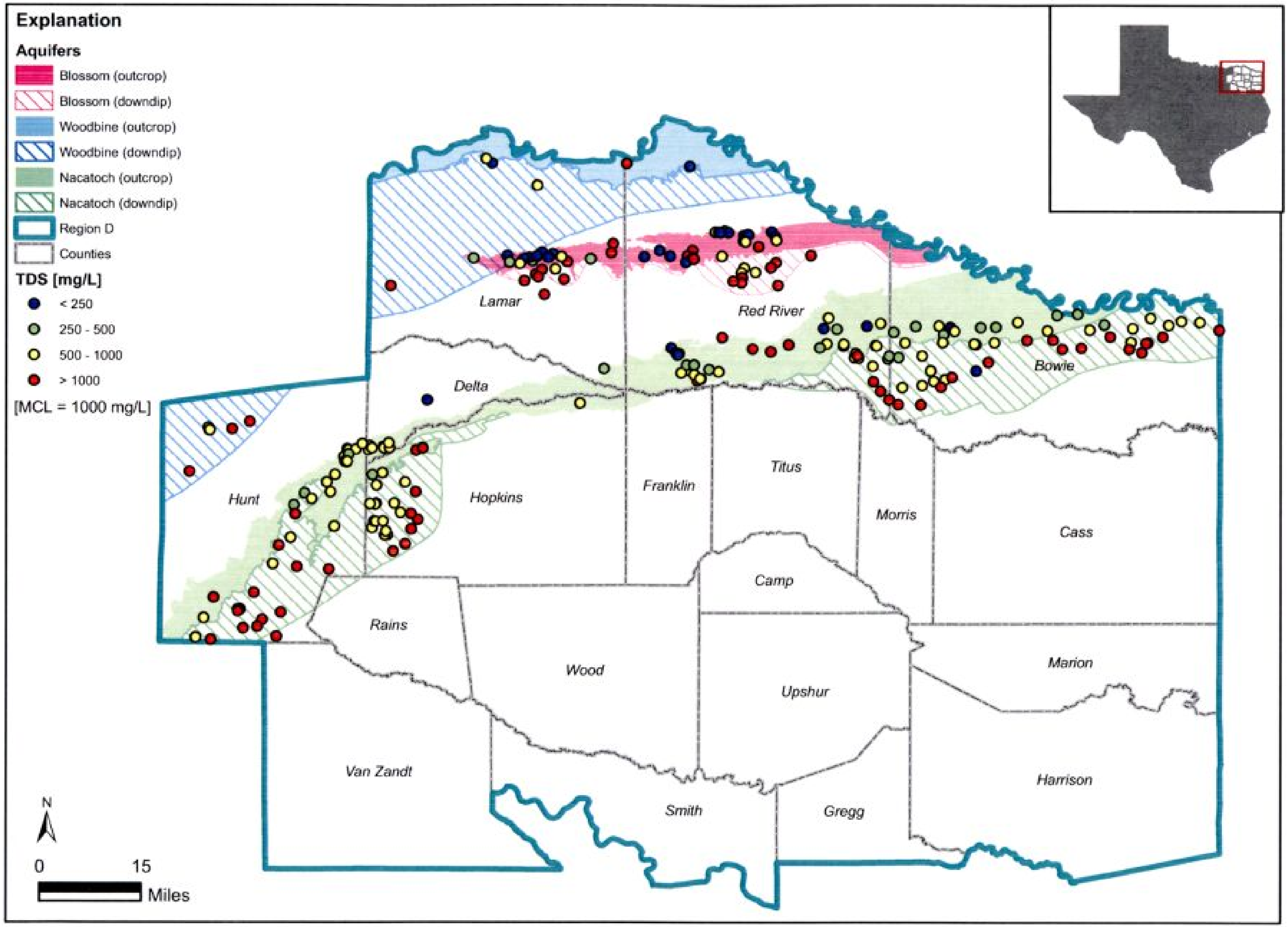
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.42



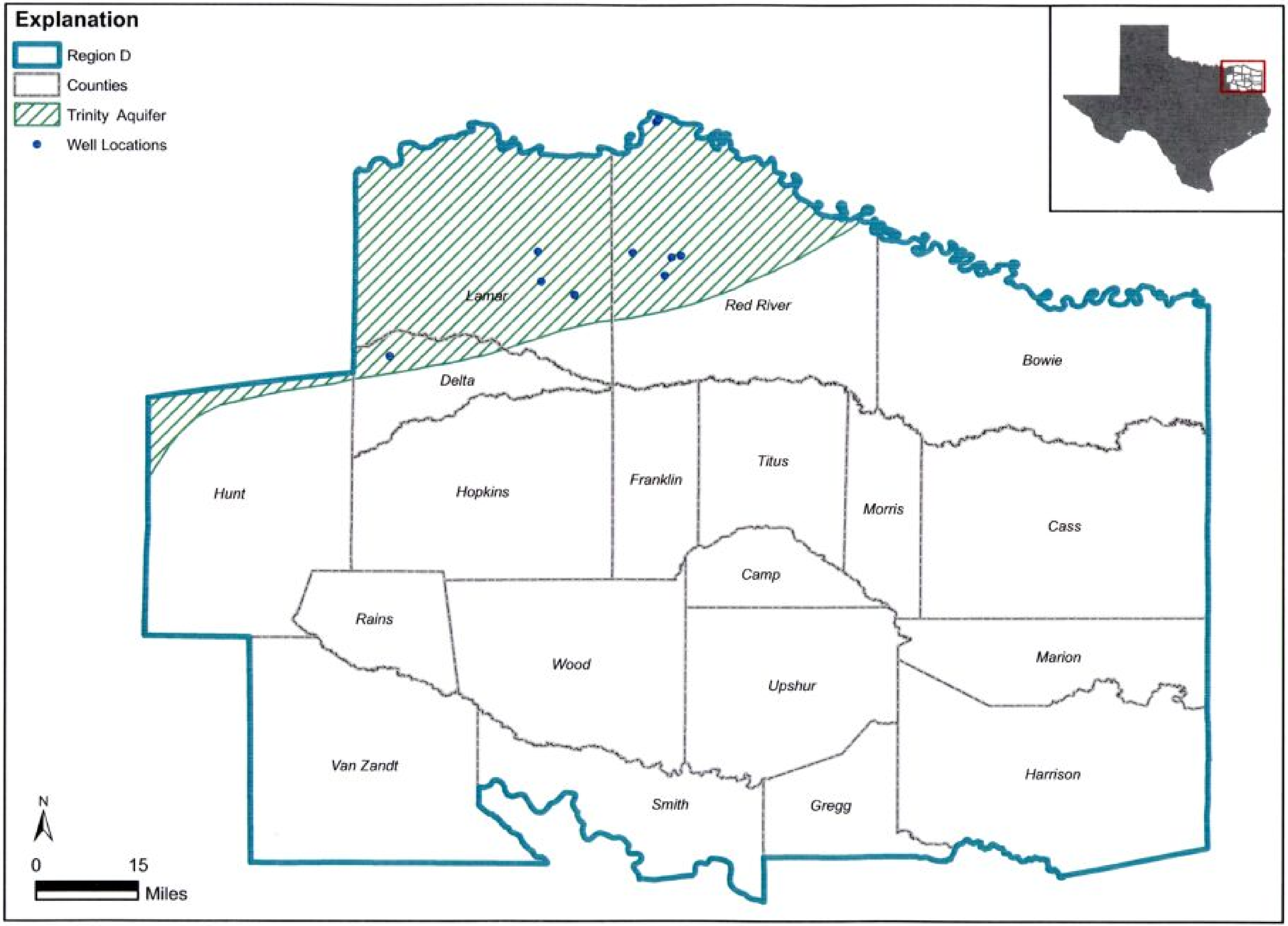
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.43



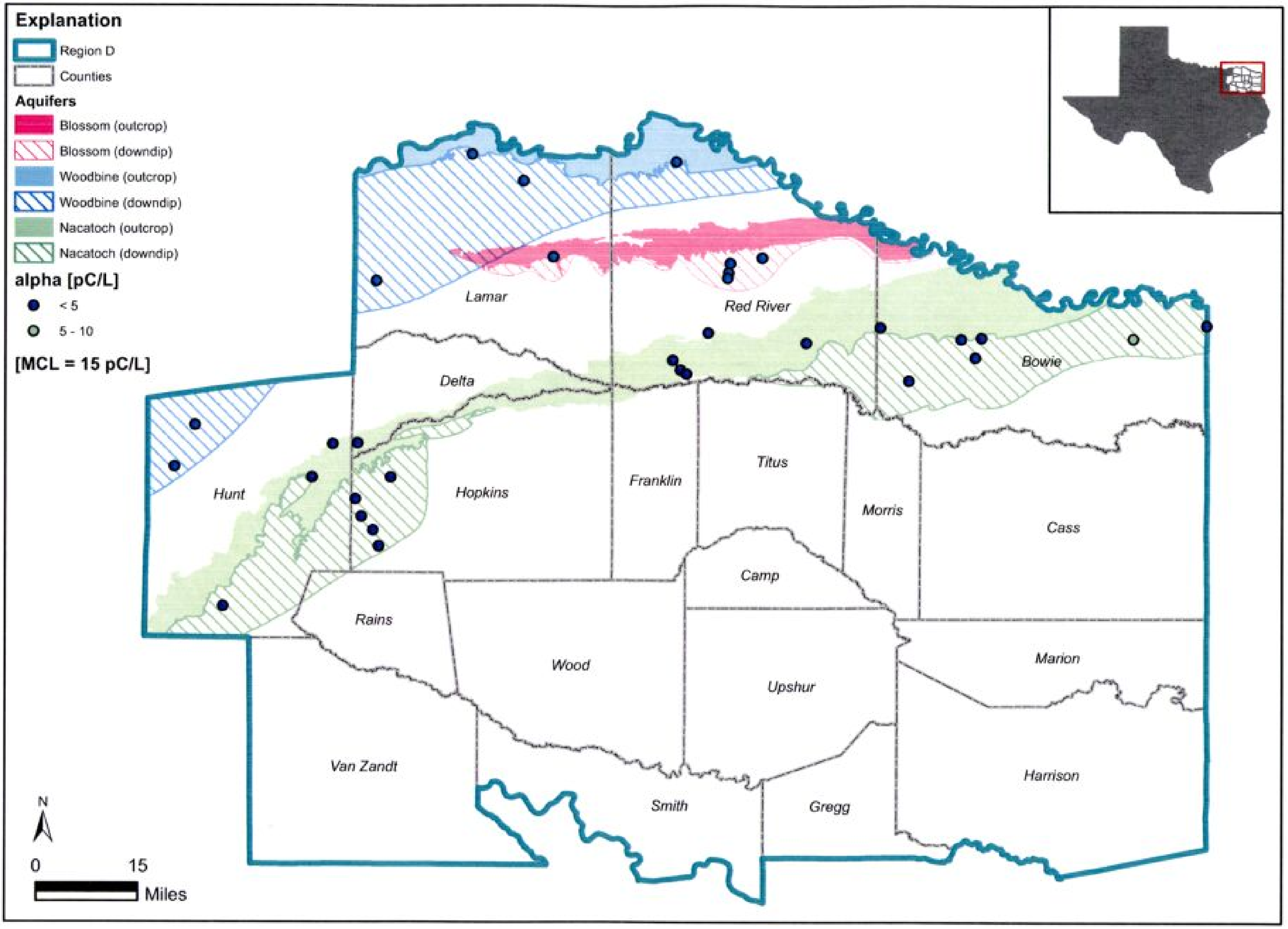
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.44



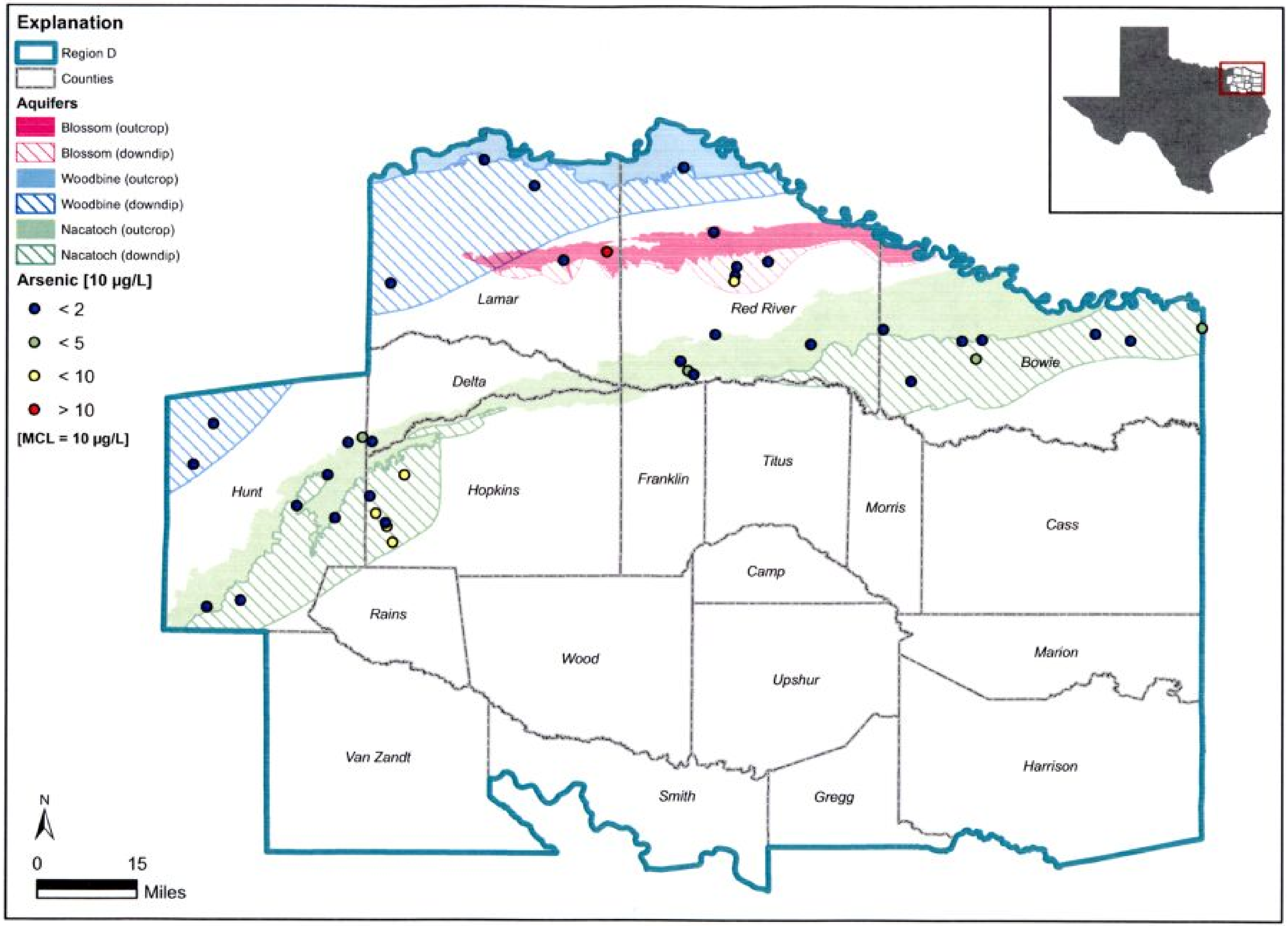
Trinity Aquifer in Region D

FIGURE A1.45



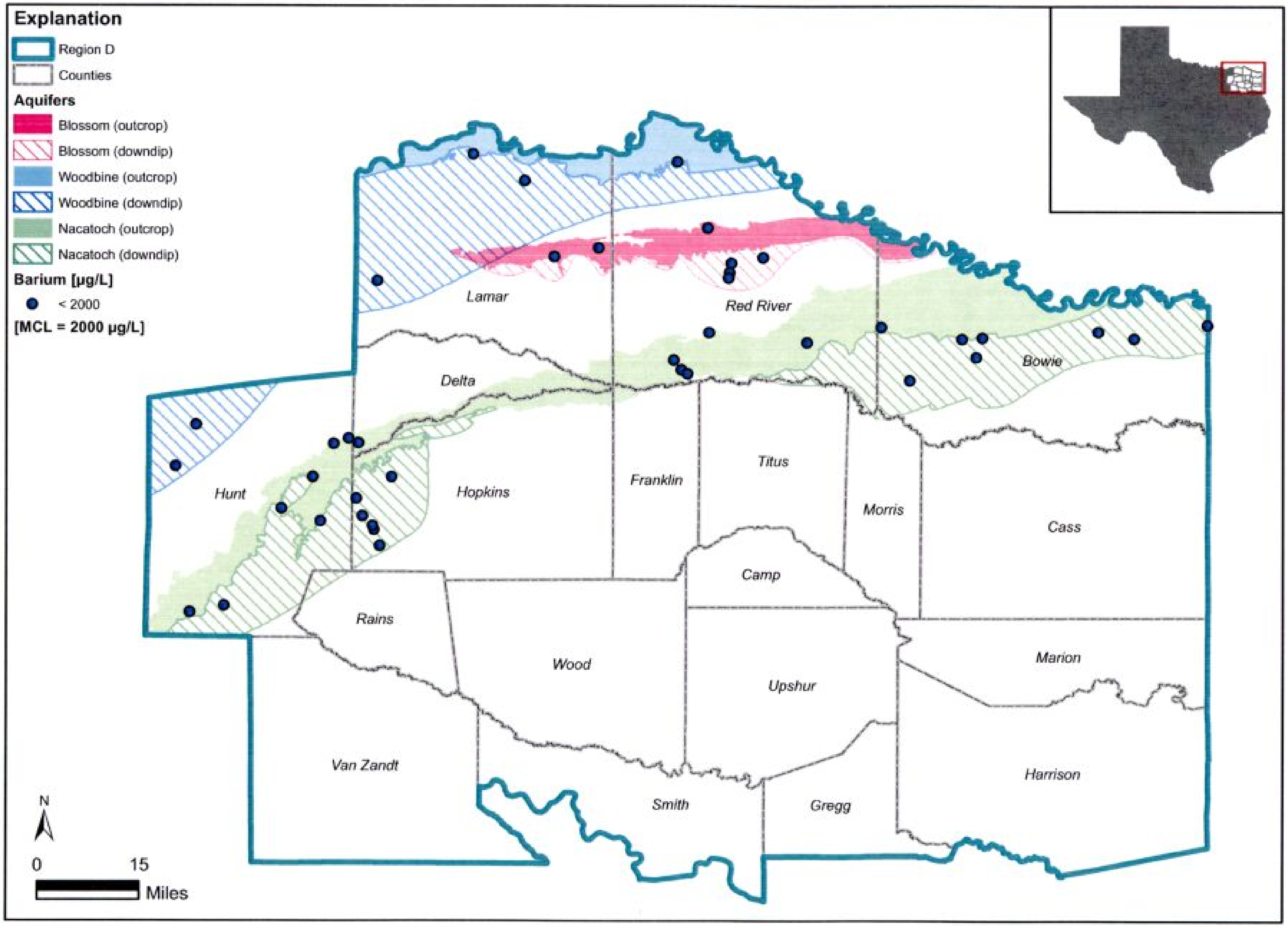
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.46



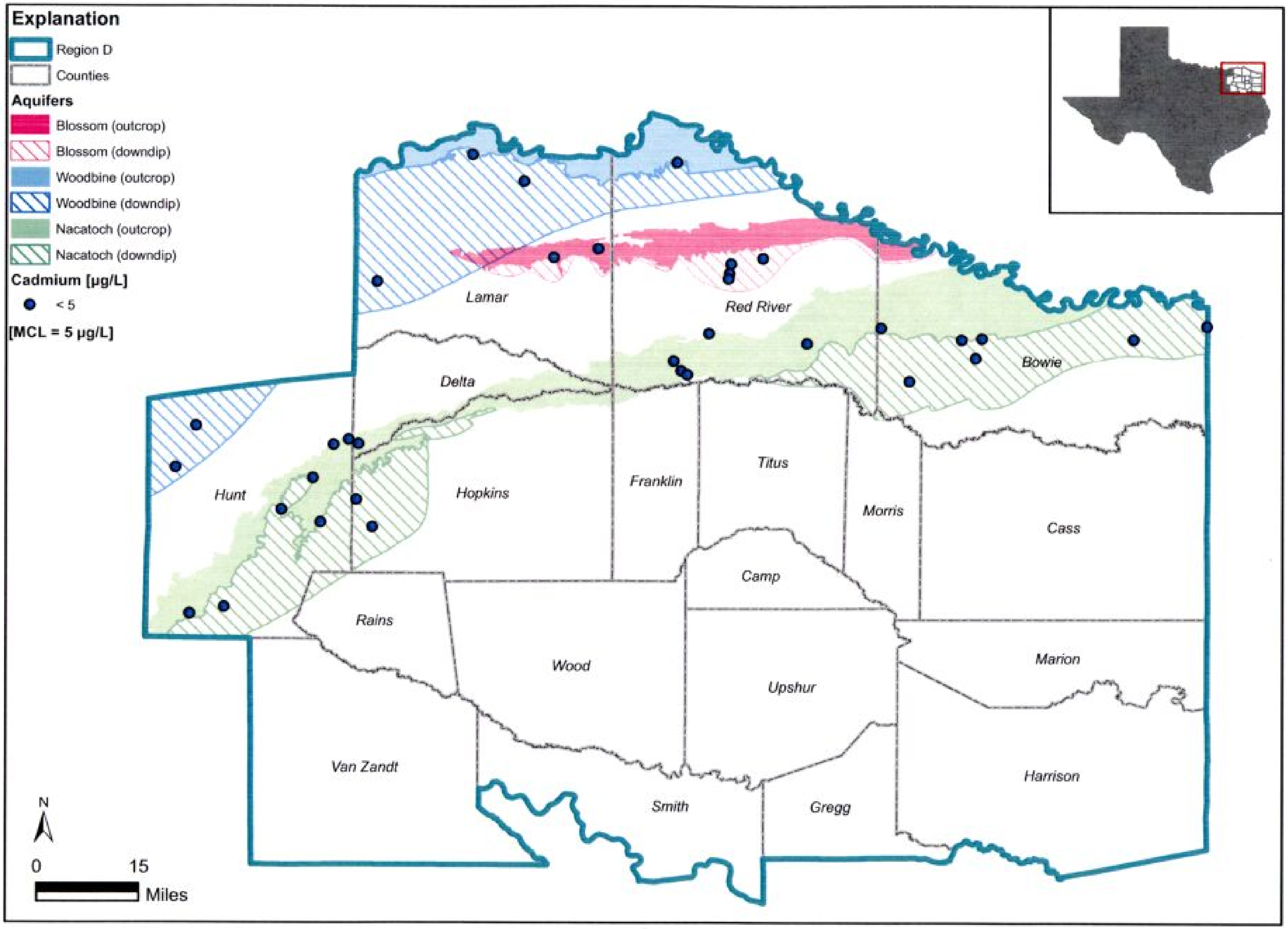
Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.47



Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.48



Blossom, Woodbine and Nacatoch Aquifers in Region D

FIGURE A1.49

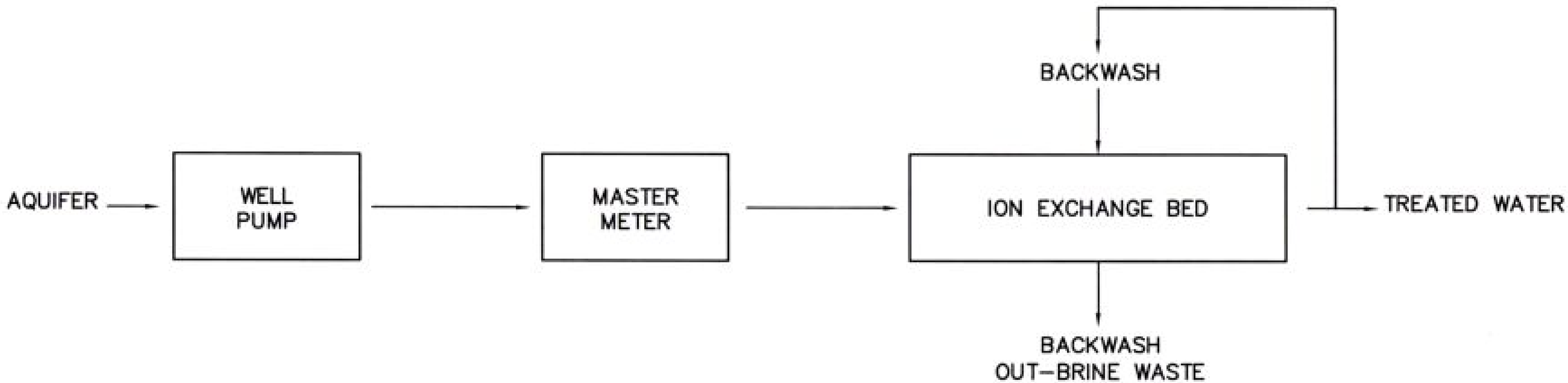


FIGURE A1.50
ION EXCHANGE FLOW SCHEMATIC

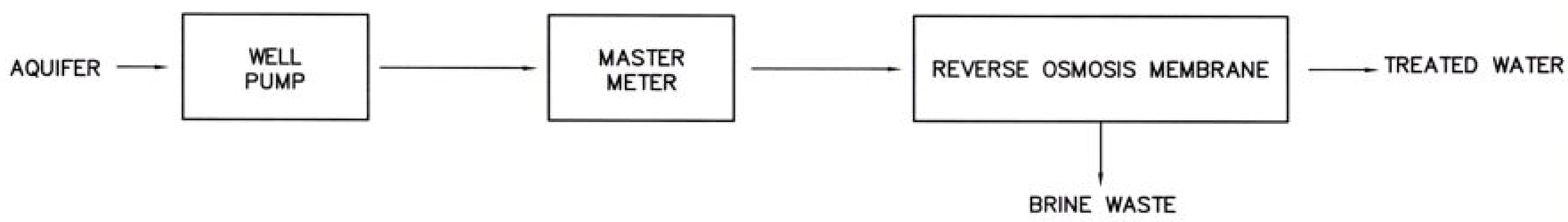


FIGURE A1.51
REVERSE OSMOSIS FLOW SCHEMATIC

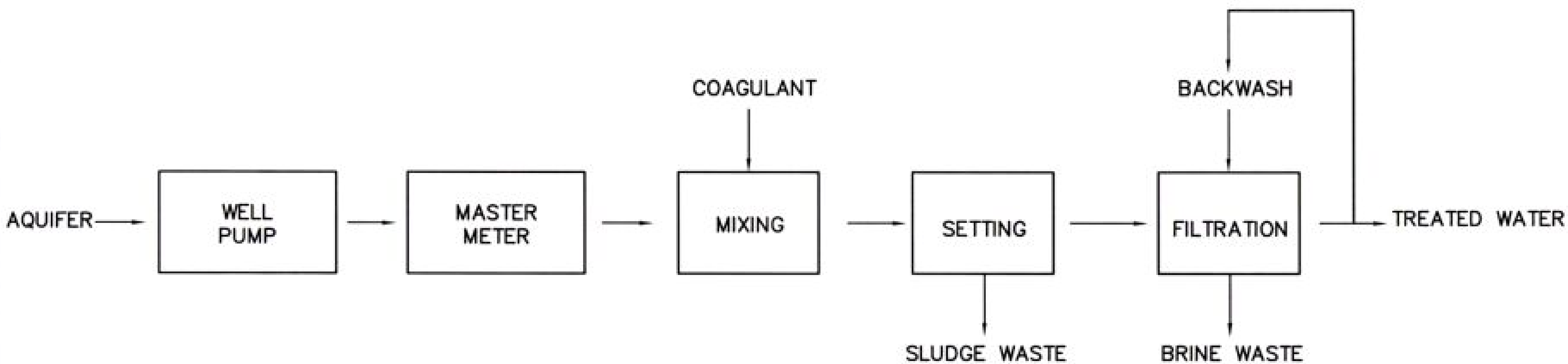


FIGURE A1.52
COAGULATION FLOW SCHEMATIC

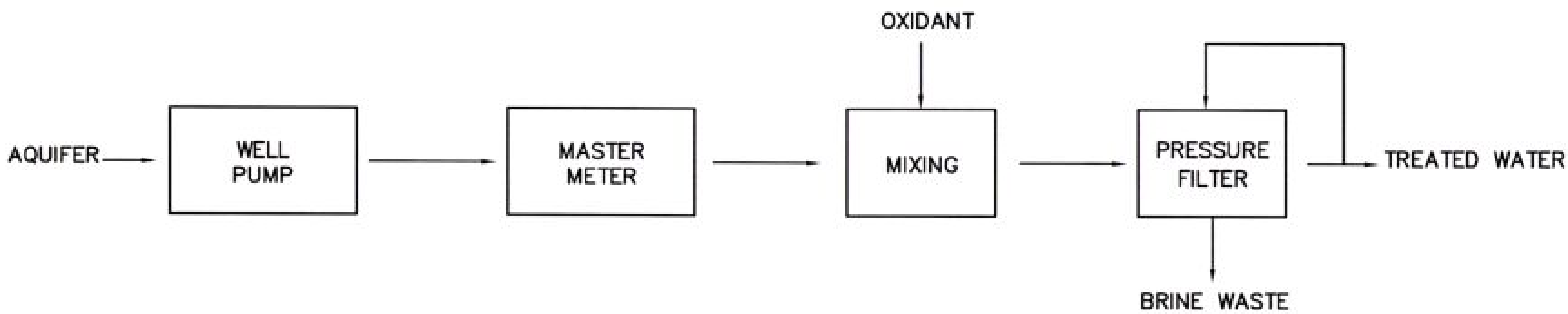


FIGURE A1.53
OXIDATION FLOW SCHEMATIC

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Task A2 – Description of Safe Drinking Water Act EPA Rules

DESCRIPTION OF SAFE DRINKING WATER ACT EPA RULES

TEXAS STATE SENATE BILL 1

2006 NORTH EAST TEXAS REGIONAL WATER PLAN SUBTASK A2

A2.1 Introduction

The purpose of this subtask as a supplement to the 2006 North East Texas Regional Water Plan is to prepare a summary of the regulations that resulted from the Safe Drinking Water Act and to prepare a timeline for when these regulations went into effect. There are approximately 257 community water systems in the North East Texas Regional Water Planning Group (NETRWPG) area with 247 serving less than 10,000 persons each. Most of these systems have no technical staff and are limited to their resources available to track and respond to changing regulations. The intent of the NETRWPG is to provide additional technical guidance to the water systems within their boundaries as a supplement to the 2006 North East Texas Regional Water Plan. This subtask is described as follows:

> "Research and prepare a brief description of existing and proposed regulations under the Safe Drinking Water Act, prepare a timeline for proposed enacting of each regulation, note its applicability to groundwater, surface water, or both, and provide a list of Region D systems that may be affected by each regulation.
>
> Compile information gathered in this subtask into the Plan, or as an appendix thereto, and make presentations to the RWPG as required."

The structure of this effort is to develop a matrix table, which list the community water systems and the existing and proposed rules to assist management within these organizations a quick reference to the applicable rules which affect their system and provide additional reference material to help educate them about the regulations. The following pages include the matrix table followed by the applicable rules and regulations.

A2.2 Purpose of Rules

The Environmental Protection Agency (EPA) is the federal agency responsible for promulgating major rules in accordance with the Safe Drinking Water Act (SDWA). From 1976 to 2002 EPA promulgated 14 major rules that resulted in the regulation of some 90 contaminants. The EPA relies on state primacy agencies (Texas Commission on Environmental Quality, TCEQ, in Texas) to regulate public water systems to ensure compliance with EPA rules. The purpose of the rules is to protect the safety and welfare of the public. The rules are intended to provide multiple barriers to protect the public health. This approach includes 1.) source water protection, 2.) treatment methods by a certified operator, 3.) storage and distribution requirements, and 4.) monitoring and public information on water quality and health effects.

In some cases the TCEQ may have rules and regulations which are more stringent than those required by EPA. Each public water system has a responsibility to become familiar with the rules and regulations of both the EPA and TCEQ in order to comply. This document is intended to be a general guide to a better understanding of the EPA rules and should not be taken as an all inclusive document covering all EPA and TCEQ Rules and Regulations.

A2.3 Existing Rules

Descriptions of the 14 major rules promulgated by EPA from 1976 through 2002 include the following:

- **Phase I Rule**. (published Ju1y 8, 1987) The Phase I, II, IIB, and V rules established monitoring requirements and maximum contaminant levels (MCL) for sixty-six chemicals (IOCs, VOCs, and SOCs). These rules do not require changes in treatment processes but require monitoring for specific chemical contaminants. If monitoring reveals contamination, treatment processes may have to altered or expanded.
- **Total Coliform Rule** (published June 29, 1989). The Total Coliform Rule (TCR) provides for improved health, safety, and welfare of the public by requiring public water supply systems to treat and monitor potable water for total coliform bacteria, including fecal coliforms and *Escherichia coli* (*E. coli*). TCR establishes monthly sampling and testing and repeat sampling requirements. All public water systems are required to comply but routine monitoring frequency varies with system population served. An EPA Quick Reference Guide is included in the appendix.
- **Surface Water Treatment Rule** (published June 29, 1989). The Surface Water Treatment Rule (SWTR) provides for improved health, safety, and welfare of the public by requiring public water supply systems to provide filtration and disinfection of potable water or comply with specific requirements to avoid filtration. SWTR requires filtration unless the system can demonstrate their source water is of the highest quality (low coliform and turbidity). All public water systems that use surface water or ground water under the influence of surface water are required to comply. Systems must ensure that the proper amount of *Giardia* and virus removal and/or inactivation is achieved. The SWTR has been expanded through the Interim Enhanced Surface Water Treatment Rule (IESWTR).
- **Interim Enhanced Surface Water Treatment Rule** (published December 16, 1998). The Interim Enhanced Surface Water Treatment Rule (IESWTR) provides for improved health, safety, and welfare of the public by requiring public water supply systems to provide improved filtration resulting in lower turbidity (0.3 NTU) levels in treated water. IESWTR requires improved turbidity performance and 99 percent removal of Cryptosporidium, a microbial contaminant. IESWTR also includes requirements for primacy agency sanitary

surveys of public water systems. All public water systems that use surface water or ground water under the influence of surface water are required to comply with sanitary survey requirements and all other requirements apply to systems serving greater than 10,000 persons . An EPA Quick Reference Guide is included in the appendix.

- **Phase II Rule.** (published January 30, 1991) The Phase I, II, IIB, and V rules established monitoring requirements and maximum contaminant levels (MCL) for sixty-six chemicals (IOCs, VOCs, and SOCs). These rules do not require changes in treatment processes but require monitoring for specific chemical contaminants. If monitoring reveals contamination, treatment processes may have to altered or expanded. Phase II promulgated a Standardized Monitoring Framework (SMF) which establishes a nine year compliance cycle with three year compliance periods.
- **Phase IIB Rule**. (published Ju1y 1, 1991) The Phase I, II, IIB, and V rules established monitoring requirements and maximum contaminant levels (MCL) for sixty-six chemicals (IOCs, VOCs, and SOCs). These rules do not require changes in treatment processes but require monitoring for specific chemical contaminants. If monitoring reveals contamination, treatment processes may have to altered or expanded.
- **Lead and Copper Rule.** (published June 7, 1991) The Lead and Copper Rule (LCR) provides for improved health, safety, and welfare of the public by requiring public water supply systems to minimize lead and copper in the potable water system. The LCR establishes monitoring requirements and includes specific action levels which require further requirements if action levels are exceeded. All public water systems are required to comply but routine monitoring requirements varies with system population served. An EPA Quick Reference Guide is included in the appendix.
- **Phase V Rule.** (published Ju1y 17, 1992) The Phase I, II, IIB, and V rules established monitoring requirements and maximum contaminant levels (MCL) for sixty-six chemicals (IOCs, VOCs, and SOCs). These rules do not require changes in treatment processes but require monitoring for specific chemical contaminants. If monitoring reveals contamination, treatment processes may have to altered or expanded.
- **Stage 1 Disinfectants Byproducts Rule.** (published December 16, 1998) The Stage 1 Disinfection Byproducts Rule (DBPR-1) provides for improved health, safety, and welfare of the public by reducing the levels of disinfection chemicals and their byproducts in public water system. Disinfection byproducts are the result of chemical reactions between the disinfectant and organics or chemicals in the source water. DBPR-1 establishes maximum disinfectant residuals and requires treatment techniques which minimize organic and inorganic compounds coming in contact with disinfectants. All public water systems are required to comply but rule typically effects surface water and ground water systems under the influence of surface waters. Compliance

schedule varies with system population served. An EPA Quick Reference Guide is included in the appendix.

- **Filter Backwash Rule. (published June 8, 2001)** The Filter Backwash Rule (FBR) provides for improved health, safety, and welfare of the public by requiring public water supply systems to recycle return flows through all processes thus minimizing risk from microbial pathogens. FBR establishes monthly monitoring and record keeping requirements for recycle flows. All public water systems utilizing surface water and ground water systems under the influence of surface waters are required to comply. An EPA Quick Reference Guide is included in the appendix.
- **Consumer Confidence Report Rule.** (published August 19, 1998) The Consumer Confidence Report Rule (CCR) provides for improved health, safety, and welfare of the public by requiring public water systems to submit an annual water quality report to its customers. The report includes a description of health effects impacted by source water, contaminants found in the system, and any violations reported. All public water systems are required to comply. An EPA Quick Reference Guide is included in the appendix.
- **Public Notification Rule.** (published May 4, 2000) The Public Notification Rule (PNR) provides for improved health, safety, and welfare of the public by requiring public water systems to notify its customers of any violations and what the possible health consequences are. The notifications are grouped into three tiers based on the level of seriousness of the violation. All public water systems are required to comply. An EPA Quick Reference Guide is included in the appendix.
- **Arsenic Rule.** (published January 22, 2001) The Arsenic Rule (AR) provides for improved health, safety, and welfare of the public by requiring public water systems to minimize arsenic levels in the potable water system. The AR establishes monitoring requirements and includes maximum contaminant levels for arsenic. This rule also clarifies two compliance requirements for IOCs, VOC's, and SOCs. All public water systems are required to comply. An EPA Quick Reference Guide is included in the appendix.
- **Radionuclides Rule.** (published December 7, 2000) The Radionuclides Rule (RR) provides for improved health, safety, and welfare of the public by requiring public water systems to minimize regulated radionuclides levels in the potable water system. The RR establishes monitoring requirements and includes maximum contaminant levels for Beta/photon emitters, Gross alpha particle, combined radium 226/228, and Uranium. This rule requires monitoring at each entry point into the distribution system. All public water systems are required to comply. An EPA Quick Reference Guide is included in the appendix.
- **Long Term 1 Enhanced Surface Water Treatment Rule.** (published January 14, 2002) The Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) provides for improved health, safety, and welfare of the public

by requiring public water supply systems to provide improved filtration resulting in lower turbidity (0.3 NTU) levels in treated water. LT1ESWTR requires improved turbidity performance and 99 percent removal of *Cryptosporidium*, a microbial contaminant. LT1ESWTR also includes requirements for combined filter effluent turbity and individual filter effluent turbidity monitoring. All public water systems that use surface water or ground water under the influence of surface water serving less than 10,000 persons are required to comply. An EPA Quick Reference Guide is included in the appendix.

A2.4 Proposed Rules

The following rules have been proposed by EPA and are anticipated to be in affect in the near future.

- **Ground Water Rule.** (proposed May 10, 2000) The proposed Ground Water Rule (GWR) is intended to protect the health, safety, and welfare of the public by requiring public water supply systems utilizing ground water as their source water to achieve a high level of virus removal and/or inactivation.
- **Radon Rule.** (proposed November 2, 1999) The proposed Radon Rule provides for improved health, safety, and welfare of the public by requiring public water systems to minimize regulated radon levels in the potable water system and in indoor air. The Radon Rule establishes monitoring requirements and includes maximum contaminant levels. Public water systems that use ground water, mixed ground and surface water, groundwater under the influence of surface water, and systems that intermittently use ground water are required to comply.
- **Stage 2 Disinfectants Byproducts Rule.** (proposed November, 2007) The Stage 2 Disinfection Byproducts Rule (DBPR-2) provides for improved health, safety, and welfare of the public by reducing the levels of disinfection chemicals and their byproducts in public water system. Stage 2 builds upon the Stage 1 requirements by requiring an Initial Distribution System Evaluation to determine where monitoring sites will be located. Systems can expect to make some operational changes in their plant operations as well as distribution operations in order to comply. All public water systems using disinfectants other than ultraviolet light are required to comply.
- **Long Term 2 Enhanced Surface Water Treatment Rule.** (proposed November, 2007) The Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) provides for improved health, safety, and welfare of the public by requiring public water supply systems to provide improved treatment based on source monitoring prior to any treatment. LT2ESWTR requires new treatment technologies for all but the best source waters. All public water systems that use surface water or ground water under the influence of surface water are required to comply.

A2.5 Attachments

The following is a list of attachments to this subtask.

Table 1 – Applicability of SDWA Rules (1996 Amendments) to Region D Public Water Systems.
Total Coliform Rule
Lead and Copper Rule
Stage 1 Disinfectants and Disinfection Byproducts Rule
Consumer Confidence Report
The Public Notification Rule
Phase I/II/IIB/V Rules
Arsenic and Clarifications to Compliance and New Source Monitoring Rule
Radionuclides Rule
Stage 2 Disinfectants and Disinfection Byproducts Rule
Long Term 1 Enhanced Surface Water Treatment Rule
Long Term 2 Enhanced Surface Water Treatment Rule
Interim Enhanced Surface Water Treatment Rule
Filter Backwash Recycling Rule
Ground Water Rule
Radon in Drinking Water Rule

Appendix to Chapter 2

Population and Water Demand Projections

Table 2.19 & 2.20

Population Projection Methodology

(Excerpt from Exhibit B – Guidelines for Regional Water Plan Development)

4.2.3 Population

This document contains information on methodologies for the development of population and water demand projections for the 2006 Regional Water Plans and the 2007 State Water Plan. For each methodology section, sub-sections are included on the methodology and key planning assumptions and on the limitations of the analysis. A section on the data sources used to develop the base data for these projections is also included. The technique for projecting county populations is a cohort-component procedure, which uses the separate cohorts (age/sex/race/ethnic groups) and components of cohort change (fertility rates, survival rates, and migration rates) to calculate future populations. Projections of each cohort are then summed to the total population. Cohorts used in the projection process are defined as single-year-of-age (0 to 75) cohorts by sex and race/ethnic groups, which include four single-race/ethnic groups.

Because the 2000 Census is the first census to allow respondents to mark one or more racial categories, a new challenge has arisen in using these data to project populations. The combinations of the six racial groups used in the 2000 Census results in 63 separate racial categories, as opposed to the eight separate racial categories in the 1990 Census. Before the 2000 Census, the Census Bureau had used four race categories: white; black; American Indian, Eskimo, or Aleut; and Asian or Pacific Islander (U.S. Bureau of the Census, 1992). More detailed categories based on ethnicity and national origin were also used (i.e. Chinese, Filipino, and Samoan). In addition, the population was classified as Hispanic or non-Hispanic, an ethnic category, not a race category. The 2000 Census expanded the number of basic categories from four to five: white; black; American Indian or Alaska Native; Asian; and Native Hawaiian or Other Pacific Islander. It may currently be impossible to construct racial-ethnic categories that are fully comparable with past categories, but the Texas State Data Center has constructed categories that approximate past categories and are "roughly comparable for those in earlier decades." Because Texans are substantially concentrated in single-race groups, the TWDB has modeled their racial category allocations after those of the Texas State Data Center who has chosen to allocate the 2.4 percent of population found in multiple-race categories to the four single-race categories of Anglo, Black, Hispanic, and Other. See Texas State Data Center (2001) "Comparing Race-Ethnicity Between the 2000 Census and Earlier Censuses" for more detailed information on racial allocations.

The components of cohort change include fertility rates, survival rates, and migration rates. Fertility rates for each female cohort are incorporated into the projection procedure for calculating the number of births anticipated to occur between each projection interval. Survival rates for each cohort are used to compute the change in the cohort size relating to the number of deaths anticipated to occur between each projection interval. Net migration rates for each cohort are used to compute the change in each cohort due to in-migration or out-migration in a specific county.

There are four main steps in applying the method: the first is to project the population alive at the beginning of the year who will survive to the target year; the second step is to project net migration by multiplying net migration rates by the adjusted population in the launch year; the third is to project the number of births and the net impact of mortality and migration on the youngest age group; and the fourth is to combine the results from the mortality, migration, and fertility modules. More detail can be found in Figure 2.

Figure 2. Diagram of the Population Projection Methodology

We will use black women, age 20, as an example in order to clarify the procedure.

We begin by subtracting out special populations from the baseline population data for 2000 by age, sex, and race-ethnicity for each county. The special populations will be added back into the new populations at the end of the projection period. (Existent population projections for special populations will be borrowed from data sources mentioned at end of section).

New baseline population 2000	=	Population 2000	-	Special Populations 2000

Survival rates, derived from mortality rates, are applied to the new baseline population in order to determine the number of survivors for the subsequent year.

Black women age 20 (year 2001)	=	Black women age 19 (year 2000)	x	Survival Rate for Black women age 19

Historically-based migration rates will then be applied to populations for each year. Migration rates for years 1990 to 2000 are computed through applying the appropriate survival rates to the population from 1990 to 2000, subtracting it from the Census 2000 enumeration, and transforming the residual figure into a rate.

Net Migration of Black women age 20 population (2001)	=	New baseline population (2000)	x	Migration Rate for Black women age 19 (1990-2000)

Black women age 20	=	Black women age 19 (year 2000)	x	Survival Rate of Black women age 19	+	Black Female Net Migration age 19

Age-specific-fertility rates are applied to the child-bearing population in order to derive the number of newborns born each year.

Age-specific-fertility-rate of black women age 20	=	Number of births to 20-year old black woman	/	Women age 20	x	100

New Births in 2001 to Black women age 20	=	Age-specific-fertility-rate of black women age 20	x	Black women age 20 in 2000

Births between males and females are allocated using historical proportions. Then the births are survived to the target year to obtain the projection of the youngest age group.

New Female Births in 2001 to Black women age 20	=	New Births in 2001 to Black women age 20	x	0.51

Black Projected Population in Youngest Age Group by Sex	=	New Births in 2001 to Black women age 20	x	Survival Rate of Black Infants by Sex

The final calculations of the components of change combine the results from the mortality, migration, and fertility modules. For all but the youngest age category, the projected population at each age is calculated as the survived population plus the net migration.

4.2.3.a County and State Population Projections

The latest population enumeration published by the U.S. Bureau of the Census in 2000 indicate that Texas currently ranks as the second most-populated state in the nation, with a population of more than 20.8 million. A large and increasing population will continue to place pressure on the State's water resources to provide sufficient quantities of water to meet local and regional water needs. Because such population growth leads to increased usage of municipal water, the TWDB develops population projections for use in assessing potential future municipal water needs. The methodology, assumptions, and data sources that will be used in the development of the population projections are presented below.

For the 2006 Regional Water Plan, future state and county population projections for each decade (2010, 2020, 2030, 2040, 2050, 2060) will be calculated using 2000 Census data with a cohort-component procedure which uses the separate cohorts (age/sex/race/ethnic groups) and components of cohort change (fertility rates, survival rates, and migration rates).

Many counties in Texas have special populations generally referred to as "institutional" populations. These groups of people are assumed not to participate in the same demographic processes as the base population and generally tend to move in and out of these institutional arrangements in fixed intervals. More specifically, these groups are defined as college/university populations, military populations, prison populations, and populations in other institutional arrangements. Institutional populations are removed from the base population for computing future cohort populations, but are added back into the total projected base cohort population at the end of each projection interval.

Key Planning Assumptions

Key assumptions used in developing the population projections are associated with the demographic components of change for each cohort and are described below:

1. Fertility rates for Anglo females are trended downward through the year 2020 and held constant at the 2020 rate through the year 2060; and fertility rates for Black, Hispanic, and Other females are trended downward through the year 2040 and held constant at the 2040 rate through the year 2060.

2. State survival rates by age, sex and race/ethnicity are assumed to follow national trends over the projection period, and are applied to all counties in the State. The reason to substitute State survival rates to county level is because that the number of deaths by single years of age for most of the counties are so small that total mortality levels are very similar among the counties.

Migration rates for State and county by age, sex and race-ethnicity are derived from the 1990-2000 populations using a residual migration method. A "most-likely" migration scenario based on 1990-2000 migration rates will be assumed and applied to the county's population, after the mortality rates have been applied.

Limitations of the Analysis

One noticeable limitation in making projections is the quality of the underlying data on which the projections are based. The accuracy of the 2000 census count may have some limitations on the accuracy of the population projections and analyses. In all censuses, there exists the possibility of an undercount, particular among minority populations. The U.S. Bureau of the Census had acknowledged that it may have under-counted the 1990 State population by as many as 500,000 people. Possible undercounts for 2000 are still being assessed. Because the population projections are based on the federally adopted 2000 census count information, an undercount could result in conservatively lower projections for some areas of the state.

Because the Regional and State Water Plan projections start at the county level and are controlled to the State-level, one of the more conspicuous limitations of such micro-level forecasting is that discrete, nontrend-type changes, such as the unexpected opening or closing of a large factory, can sometimes have a significant, unanticipated effect on the population and water demand projections. Any unforeseen changes in the factors affecting the migration rates, fertility rates, or mortality rates can result in an under- or over-projection of the State's population.

4.2.3.b Sub-County Population Projections

The 2002 State Water Plan contained 943 of the approximately 1,200 incorporated areas in the State. In addition, 28 Census Designated Places with population greater than 500 (1997 population estimates) were included in the 2002 State Water Plan.

The 2006 Regional Water Plan will include specific plans for a greater number of entities by projecting population and water demands for unincorporated areas supplied by public water utilities (non-municipal retail water suppliers) above a particular size (see below). In the current, and previous State Water Plans, these unincorporated areas were aggregated into the County-Other WUGs. With a greater public awareness of water planning and a greater emphasis placed on WMSs for any area that may face a water shortage, this aggregation of unincorporated areas has now been reduced. Although the exact number of water utilities that will have populations projected is not currently known, it is estimated that over 500 utilities meet the minimum water use requirements.

Population projections for areas below the county level will be calculated for the following:

1. Incorporated areas (cities) with populations of 500 or more in the 2000 Census.

2. The county population outside cities of more than 500, previously considered as a single Water User Group called County-Other, may be further subdivided based on the following criteria:

   a) If the County-Other population for a county is served by at least one, but fewer than five, utilities which in Year 2000 provided more than 280 acre-feet of water to its entire service area, the population served by each utility will be considered a separate Water User Group. TWDB staff will develop draft estimates and projections of population and water demand for these Water User Groups and for the remaining County-Other population outside these utility service areas.
   b) If the County-Other population for a county is served by five or more utilities which in 2000 provided more than 280 acre-feet of water to its entire service area, the Planning Group shall determine if and how the County-Other population will be subdivided and designate in its contract whether such utilities, in these counties, will be treated as individual Water User Groups or combined with other utilities in logical reporting units (such as being served by a common wholesale water provider, having a common source or other association appropriate for the area). TWDB staff will be responsible for developing estimates and projections of population and water demand for the chosen Water User Groups and for the remaining County-Other population outside utility service areas.

Projection Methodology and Key Planning Assumptions

As described above, the use of the cohort-component procedure for the projection of county populations requires detailed data that are not available for areas smaller than the county level. For this reason, the projections for cities, water utilities and the County-Other will be based on a share of the county's population growth between 1990 and 2000.

The share-of-growth ratio method examines the city's (or utility's) share of the county's population growth between 1990 and 2000. It is then assumed that the area's share of the county's population growth will be the same in the future as it was between 1990 and 2000 (Table 1). In the table below, City A had 83 percent of the county's growth between 1990 and 2000 and will be projected to have 83 percent of the growth in each future decade.

Problems arise in this method if the area experienced population decrease between 1990 and 2000 while the county experienced an increase. If the county is then projected to experience greater growth in the future, the city or utility will experience dramatic decreases throughout the planning horizon. In these cases, the share-of-growth ratios will be adjusted by staff to appropriate levels based on historical data.

While the share-of-growth ratio method will be used as the base for sub-county level projections, adjustments may be made in cases where reliable local input may identify cities which have reached their maximum growth potential or cities which are expected to experience significantly greater growth rates than shown by historical data.

4.2.3.c Base Population for Cities and Qualifying Utilities

The base year for the city, utility and county-other projections will be the Year 2000. All cities will use the Census 2000 figures for the base population. For the utilities, a Year 2000 population will be estimated through the use of Water Use Survey information and the sum of Census Block populations within the utility's service area.

Table 1. Share-of-Growth Ratio Method Example

	1990 Census	**2000 Census**	**1990-2000 Growth**	**Percent of County's 1990-2000 Growth**	**Projected 2000-2010 Growth**	**Projected 2010 Population**
County X	150,000	261,700	111,700		90,300	352000
City A	105,000	198,000	93,000	83.26%	75,183	273,183
City B	20,000	33,000	13,000	11.64%	10,509	43,509
Utility A	500	700	200	0.18%	162	862
Utility B	15,000	19,000	4,000	3.58%	3,234	22,234
Remaining County-Other	9,500	11,000	1,500	1.34%	1,213	12,213

4.2.3.d Census Designated Places

In the 1997 State Water Plan, populations were projected for 30 of the 105 CDPs in the State. These places are "communities that lack separate governments but otherwise resemble incorporated places. They are settled population centers with a definite residential core, a relatively high population density, and a degree of local identity. Often a CDP includes commercial, industrial, or other urban types of land use (U.S. Census Bureau)." CDPs are delineated by State and local agencies before each census and may change between censuses.

Projections will not be created for CDPs in the 2007 State Water Plan, unless the CDP represents a non-local government entity that provides water service in the same manner as a local government or utility. The primary examples would be military bases. Otherwise, projections for CDPs will not be created for the following reasons:

1) Projections for CDPs are not required in TWDB Rules.

2) In projecting population for qualifying utilities, projections will be created for 24 of the 48 CDP areas projected for in the 1997 State Water Plan.

3) To project for all of the CDPs would include adding over 100 Water User Groups with possibly very little water use data.

The CDPs that had population projections in the 1997 State Water Plan but will not be projected for in the 2006 Regional Water Plans are listed in Table 2.

Table 2. List of CDPs that will not be projected in the 2007 State Water Plan

ALDINE	GARFIELD	SALADO	THE WOODLANDS
ANDERSON MILL	HOMESTEAD MEADOWS	SAN ELIZARIO	TOWN WEST
BATESVILLE	KINGSLAND	SAN LEON	WELLS BRANCH
BOLING-IAGO	LA PRYOR	SEBASTIAN	WEST ODESSA**
BRUSHY CREEK	MARKHAM	SPRING	WESTWAY
CHANNELVIEW	McQUEENEY	STOWELL	WIMBERLEY
COMFORT	MISSION BEND	SULLIVAN CITY	WINNIE
FIRST COLONY*	POTOSI		

*Annexed by the City of Sugar Land
**Not included by the Region F Water Planning Group in the Regional Water Plan, population was returned to county-other.

Criteria for Revision of Population Projections

(as presented in Exhibit B – Guidelines for Regional Water Plan Development)

Population and water demand projections, for 2010 through 2060, for the State, counties, cities, and county-other (including utility sub-components) will be reviewed through a process coordinated by the Executive Administrator of the TWDB with the Planning Groups, TNRCC, TDA, and the TPWD.

Beginning in January 2002, TWDB will meet on a regular basis with representatives of TNRCC, TPWD, TDA, and the Planning Groups. These meetings will serve to review and achieve consensus, on a county by county basis, on the assumptions (primarily those related to rates of migration) necessary to estimate the future county-level populations that are most likely to occur.

After this process of determining appropriate assumptions is completed, on or about April 30, 2002, the county populations will be distributed among cities, utilities, and county-other. When these distributions are completed, draft population projections for all WUGs will be completed on or about August 2, 2002. Draft water demand projections will be released in the Fall of 2002. The Planning Groups will have the opportunity to review the projections and request revisions through the process described below.

Any entity or rural area (County-Other) wishing to have their respective population or water demand projections revised will address their request through their Planning Group. If the Planning Group agrees with the request, the Planning Group will submit the request to the Executive Administrator of the TWDB along with the data required showing how the entity meets the specific criteria for eligibility for revisions, as specified in these guidelines. Additionally, the proposed revised projections for any specific entity or rural area of a county must accompany the request along with documentation of how the revisions or alternative projections were derived.

Board staff will coordinate the review of each request with the staff of TNRCC, TPWD, and TDA based on specific criteria and data requirements as set forth in these guidelines and will consult the Planning Group and/or their consultant concerning the review of the information. All final population and water demand projections are anticipated to be presented for the approval of the Board in early to mid 2003.

4.2.5.b Population

County-Level Population

TWDB staff will project population by decade for each county in the State and then sum the county populations to a Regional total. Any adjustments to a county-level population must involve a justifiable redistribution of projected county populations within the region so that the summed regional total remains the same.

Criteria for Revision: One or more of the following criteria must be verified by the Planning Group and the Executive Administrator for consideration of revising the county population projections:

a) A possible Census undercount took place in the county and action is currently being pursued to request a Census Bureau correction.
b) If there is evidence that the 2000-2010 net migration rate will be significantly different than the net migration rate used for the original projection.
c) There are statistically significant birth and survival rate differences (by appropriate cohorts) between the county and the State.

Data Requirements: The Planning Group must provide the following data associated with the identified criteria to the Executive Administrator for justifying any revisions to the county-level population projections:

1. Documentation of an action requesting the Census Bureau correct an undercount of population within a county.
2. Projected in migration and out migration of a county, indicating that the net migration of a county will be significantly different than the net migration rates previously used.
3. Birth and/or survival rates for a county population between 1990-2000 by gender, race/ethnicity and single-year age cohorts.
4. Other data that the Planning Group believes is important to justify any changes to the population projections.

Sub-County Population

The projected population growth throughout the planning period for the cities, utilities and rural area (County-Other) within a county is a function of a number of factors, including the entity's share of the county's growth between 1990 and 2000, as well as local information provided by Planning Groups. The total county population, as projected by TWDB will act as a control total for the populations within the county. Any adjustments to a city, utility or remaining County-Other population must involve a justifiable redistribution of projected populations within the county so that the county total remains the same.

Criteria: One or more of the following criteria must be verified by the Planning Group and the Executive Administrator for consideration of revising the sub-county population projections:

a) The population growth rate for a city, utility or County-Other over the most recent five years is substantially greater than the growth rate between 1990 and 2000.
b) Identification of areas that have been annexed by a city since the 2000 Census.
c) Identification of the expansion of a utility's CCN or service area since the last update by the TNRCC to the digital boundary data.
d) Identification of growth limitations or build-out conditions in a city or utility that would result in maximum population that is less than was originally projected.

Data Requirements: The Planning Group must provide the following data associated with the identified criteria to the Executive Administrator for justifying any revisions to the sub-county-level population projections:

1. Population estimates for cities developed and published by the State Data Center or by a regional council of governments will be used to verify criteria (a) for cities.
2. The verified number of residential connections and permanent population served will be used to verify criteria (a) for utilities.
3. The estimated population of an area that has been annexed by a city (for criteria b) or has become part of a CCN or service area for a water utility (for criteria c). In addition, the geographical boundary of the area must be presented in an acceptable map or ArcView shapefile.
4. Documentation from an official of a city or utility describing the conditions expected to limit population growth and estimating the maximum expected population will be used to verify criteria (d).
5. Other data that the Planning Group believes is important to justify any changes to the population projections.

Water Demand Projection Methodology

(as presented in Exhibit B – Guidelines for Regional Water Plan Development)

4.2.4 Demands by Use Type

4.2.4.a Municipal Water Demands

The amount of water used for municipal purposes in Texas depends primarily on population growth, climatic conditions, and water conservation practices. For planning purposes, municipal water use comprises both residential (single- and multifamily housing) and commercial and institutional water uses. Commercial water use includes business establishments, excluding industrial water use. Residential, commercial, and institutional uses are categorized together because of the similarity of uses; that is, they all require water primarily for drinking, cleaning, sanitation, air cooling, and outdoor use.

Projection Methodology and Key Planning Assumptions

Municipal water demand will be calculated for the WUGs designated in the population projections process. The methodology for forecasting municipal water demand relies on two primary components: (1) population projections and (2) forecasts of per capita water use. Population projections were discussed in the previous section. Forecasts of per capita water use and conservation are discussed in detail next.

Population Projections as a Component of Municipal Water Demand Projections

Projected municipal water demand will be based on the Year 2000 per-capita water use, calculated with Year 2000 population counts (see earlier section).

Per Capita Water Use and Weather Influences

The quantity of water used for municipal purposes is reported to the TWDB on an annual basis by cities and other water suppliers such as rural water supply corporations, municipal utility districts, fresh water supply districts, and other types of water suppliers. The types of information reported include groundwater and/or surface water use, source of the water (aquifer, river, reservoir, or stream), water sales and water purchases to other municipalities and end-users, number of service connections, estimated population served, and other pertinent information. This information provides for the identification of the water use and water supply network for each geographical area of Texas.

Per capita water use is the average amount of water used by each person, which is based on calculation of total water use divided by population. Texas has a wide range of per capita water use because of the diversity of climatic conditions, population density, relative density of commercial businesses, consumers' ability to pay for water as indicated by average incomes, effectiveness of local conservation programs, and availability of water across the State. Climatic conditions also affect the varying quantities of water used annually. The frequency of rainfall plays a major role in the quantity of water used for municipal purposes, particularly for outdoors.

During below-normal rainfall conditions, people tend to use more water than during normal weather conditions. Below-normal rainfall was the basis for all water-use projections in the 2002 State Water Plan, representing the requirement under Senate Bill 1 to plan for drought-of-record conditions (Texas Water Code §16.053(e)(4)).

1997 and 2002 Water Plan Methodologies

Projections of per capita water demand made for the 1997 State Water Plan were used, according to Senate Bill 1, as the foundation for the 2002 State Water Plan. The per capita water use for normal rainfall conditions was based on the average per capita water use for each city between 1987 and 1991, a time period that did not include extreme rainfall conditions in most areas of the State. The per capita water use for below-normal rainfall conditions was based on the highest per capita water use recorded by a city between 1982 and 1991, with 1982-1986 added into this part of the analysis because drought conditions were represented. For planning purposes, the per capita water use for below-normal rainfall was constrained to an upper limit of 25 percent above the calculated (5-year average) normal-condition per capita water use variable. This constraint was used as an adjustment for water conservation practices put in place after 1985.

2006 Water Plan Methodology

Issues may arise when the 'dry-year', and the accompanying GPCD, is chosen from a range of years. First, if the 'dry-year' is between census year (1990 and 2000), then a population estimate is used to calculate the GPCD. In fast-growing or otherwise difficult to estimate cities, the difference between the estimates and what is found to be the actual population in the next census may be significantly different. This difference would result in an erroneous GPCD estimate to be carried forward in the projections. Second, if the 'dry-year' was in the early 1990s, the GPCD may not reflect conservation efforts made by the city in the later half of the decade.

In an attempt to avoid these two situations, the Year 2000 will be used as the 'dry-year' and the accompanying GPCD to be used as the base for projecting municipal water demand. The Year 2000 was chosen to base the projected municipal water demands on for the following reasons:

(1) The population figures will be more accurate than any single-year population estimates between 1990 and 2000.
(2) According to the Palmer Drought Severity Index for the past decade, the Year 2000 was the driest year in the last decade for the majority of the regions and for the State as a whole.
(3) Year 2000 water use data also takes into account not only a dry-year water usage, but the water use savings that have resulted to date from the 1991 State Water-Efficient Plumbing Act or conservation programs supported by the city or utility.

Municipal Water Conservation

For the 1997 State Water Plan, TWDB staff estimated the per capita water use savings that would be the result of various municipal conservation measures, including water-efficient fixtures, lawn-irrigation conservation, public education, system water-leak detection, and commercial conservation. Upon selecting a base GPCD, savings were subtracted from the base GPCD over the planning horizon to produce the projected GPCDs. The municipal water demand projections listed in the 1997 State Water Plan included these savings.

In the 2002 State Water Plan, the projected GPCDs for cities and county-others were, for many of the areas, based on requests for revisions by the Planning Groups. Though the GPCDs were revised for many of the cities throughout the State, the savings due to various conservation measure were retained. The regions were not required to retain the schedule of savings nor describe any substituted schedule of conservation savings.

In the 2006 Regional Water Plans, a base GPCD will be the reported GPCD for the designated 'dry-year'. Water use reductions expected in future years due to continued adoption of water-efficient plumbing fixtures, as detailed in the 1991 State Water-Efficient Plumbing Act, will need to be included by the Planning Group and will be based on information and data provided by the TWDB. Any projected GPCD savings due to conservation programs to be undertaken by cities or utilities over and above the savings reflected from the 1991 State Water-Efficient Plumbing Act will be listed as a separate WMS by the Planning Group.

Limitations of the Analysis

As previously mentioned, climatic conditions play a major role in the quantity of water used for municipal purposes. Even though the assumed below-normal rainfall per capita water use estimate reflects a short-term dry condition, it is not a per capita water use estimate associated with an extended period of drought. Consequently, these projections could result in significantly underestimating municipal water demand associated with an extended drought. Municipal demand, defined here, is the quantity of water that a city would be willing to purchase or use if sufficient quantities of water were available.

During the past few years, some municipalities in Texas have implemented water use restrictions due to insufficient treatment capacities or lack of available water supplies during extended dry periods. Temporary restrictions of water use may be imposed during water supply shortages associated with drought or system delivery problems. These types of temporary restrictive practices are not intended to be incorporated into the municipal water demand projections, although reduction in water use due to implementation of drought plans can be utilized as a WMS.

4.2.4.b Irrigation Water Demands

A comprehensive irrigation survey was performed in 2000 that provided up to date crop and irrigation data for consideration in making changes to the 2002 State Water Plan water demand projections. These estimates for acreage under irrigation and individual crop needs, supplied by the Natural Resource Conservation Service (NRCS), data developed in the previous two State Water Plans (1997 and 2002), and new data based on Potential Evaporation (PET), will be used for verification of baseline values and for trends.

The process of estimating irrigation demand in the Irrigation Survey is straightforward. The acreage planted for each crop under irrigation is estimated for each county. The crop water applications for each crop are estimated by NRCS and multiplied by the acreage to give total irrigation used.

Research is ongoing at TWDB to develop PET-based crop water demands, reduced by the amount of beneficial rainfall received, to be used for comparison to NRCS estimates of irrigation applications. That amount (irrigation needed) is multiplied by the irrigated acreage planted as reported by the Texas Agricultural Statistics Service (TASS).

The results are total irrigation water demands by crop for each county. These individual crop irrigation water demands are added and the county totals and regional totals are calculated. The final step is to add back in water amounts that are lost in the process of transportation to the field for crops using surface water.

Projection Methodology and Key Planning Assumptions

The 1997 State Water Plan irrigation demand projections were reviewed and revised by the Planning Groups as provided for by Senate Bill 1 and the TWDB rules for making revisions. The 2002 State Water Plan is based on the approved revisions to the 1997 State Water Plan numbers. The 2002 Plan projects a reduction of irrigation water demand of 14 percent over the period from 2000 to 2050.

Crop acreage data developed from comparing the 2000 Irrigation Survey and the 2002 State Water Plan will be used to represent cropping patterns for the 50-year planning period, unless limited by processes known to exist or anticipated to develop during this time frame. Examples such as water non-availability due to aquifer overdraft thereby reducing cropping, or farmland conversion to municipal land use are two processes that could alter cropping patterns. The rates of change for irrigation water use as projected in the 2002 State Water Plan will be largely retained. The crop water demands contained in the 2002 State Water Plan were approved by each Planning Group and reflect increased on-farm efficiencies and anticipated cropland losses.

The 2007 State Water Plan will use the 2002 State Water Plan projections as a baseline. The 2000 Irrigation Survey (completed after the 2002 projections were approved) will be used to detect changing trends in the most recent years. PET-based estimates, where available and appropriate, may also considered during the development of demand projections.

Adjustments to the 2002 State Water Plan projections will be made based on several factors. One factor is recent increases or decreases in the amount of acreage under irrigation (if the change in irrigated acreage is reasonably expected to be maintained). Another factor is increases or decreases in canal losses (for surface water diversion losses) for those counties reporting canal losses in the past.

Surface Water Conveyance Losses

In 2000, 6.51 million acres of cropland were irrigated using 9.77 million acre-feet of water. Of these 6.51 million acres, 6.375 million were single cropped and 135,000 acres were double cropped. In addition to the 9.77 million acre-feet of water used on-farm, an additional amount of water was not used on-farm but should be considered in calculating irrigation needs. This "lost" water can be calculated as a percentage of surface water used on-farm. In 1995 the diversion losses were 622,043 acre-feet, representing about 19 percent of the 3.15 million acre-feet of surface water diverted or 25 percent of the 2.38 million acre-feet of surface water used on-farm. Using a similar percentage the diversion losses for 2000 can be estimated as 415,456 acre-feet (25 percent of 1,661,864). A comparison of surface water diversions (from TNRCC records) and total on-farm crop needs as determined in the 2000 Survey of Irrigation conducted for the TWDB by the NRCS can be used as a control for actual diversion losses.

Conveyance loss, also referred to as diversion loss, is the amount of water lost during the delivery of surface water from the point of diversion on the river or stream to the point of use on the farm. Surface water is typically conveyed by an open canal system, which exposes the water supply to possible loss from seepage, breaks, evaporation, and uptake by riparian vegetation. Surface water irrigation comprises about 31 percent of the total agricultural irrigation water use in Texas and occurs primarily along the upper and middle Texas Gulf Coast, along the Rio Grande, and in some areas of the Texas Hill Country. For areas of the state using surface water for irrigation, the water use estimates in 1990 and projections from 2000 to 2050 include conveyance losses. For areas of the state using groundwater for irrigation, water use estimates and projections do not include conveyance losses because groundwater is generally pumped on or near the point of use.

Although surface water irrigation represents a relatively small portion of irrigated agriculture, the loss of water through conveyance can be considerable. Estimates of loss can range between ten and 55 percent of the total amount of water diverted. Some surface water supply entities have tried to reduce water losses by making improvements to their conveyance systems. Such improvements can include repairing weaknesses in the canals, controlling vegetation, and lining the canals. These improvements can be expensive, and not all entities have the necessary capital for investment.

Because funding for capital improvement varies between entities or was uncertain in the future, the 1997 State Water Plan used the scenario that assumed that no improvements requiring capital investment would be made. It did assume conveyance loss would decline slightly as management practices improve. The 2002 State Water Plan and 2006 Regional Water Plan projections will make a similar assumption - that no significant capital improvements to canals will be made and no reduction of canal losses will be built in to the projections. Additional information relating to recent canal improvements, and planned expenditures for improvements will be gathered from communications with river authorities, water districts, and irrigation companies. A survey of all irrigation districts reporting canal losses can be made inquiring as to their expected level of diversion loss. For all counties with surface water irrigation demands, Planning Groups will be provided with information on the assumed conveyance loss separately from on-farm demand.

Limitations of the Analysis

The limitations to the methodology are the accuracy to which crop patterns may be estimated and the accuracy to which irrigation water use can be estimated for each crop. A pilot study using remote sensing in conjunction with on the ground surveys is underway in 5 counties. The remote sensing data should be more accurate as far as crop acreage is concerned.

Increased reliance on PET data may produce better estimates of irrigation need. However, irrigation water applications that are metered are the best method of determining actual use. Better use of electronic data sharing between the agencies producing the data and the TWDB would increase the reliability of the data, by reducing the chance of transcription errors. Therefore, the limiting factors for crop acreage and water use are the data collection methods.

4.2.4.c Livestock Water Demands

Although livestock production is an important component of the Texas economy, the industry consumes a relatively small amount of water. In 1990, total livestock production consumed approximately 274,000 acre-feet of water in Texas, representing less than two percent of the total water use. The 2000 total livestock water demand was projected in the 2002 State Water Plan to be 330,500 acre-feet.

Projection Methodology and Key Planning Assumptions

Estimating livestock water consumption is a straightforward procedure that consists of estimating water consumption for a livestock type and the total number of livestock of that type in each county. Texas A&M University Agricultural Extension Service has published information on water use rates, estimated in gallons per day per head, for each type of livestock: cattle, poultry, sheep and lambs, and hogs and pigs. The Texas Agricultural Statistics Service provides current and historical numbers of livestock by livestock type and county.

The 2006 Regional Water Plan will maintain the same rates of change in livestock water demand as included in the 2002 State Water Plan. Base water use for 2000 will be adjusted using the 2000 livestock inventory along with adjustments in water use per unit, based on research by the Texas Agricultural Experiment Station. Rates of water use for each type of livestock and calculations for the 2000 estimated livestock water demand are shown in Table 3.

Table 3. Livestock Water Use

Livestock Type	Water Needs*	2000 Population**	Livestock Water Demand
Other cattle	15.00	10,650,000	178,943
Dairy cattle	75.00	350,000	29,404
Fed cattle	15.00	2,900,000	48,726
Hogs and Pigs	11.00	870,000	10,718
Sheep	2.00	1,200,000	2,688
Goats	0.50	1,300,000	728
Hens (thousand)	90.00	18,165	1,830
Broilers (thousand)	15.00	508,000	8,535
Horses	12.00	750,000	10,082
Texas State Total 2000			**291,564**

* Water needs expressed in gallons per day
** Population as of January 1, 2000

4.2.4.d Manufacturing and Mining Water Demands

The TWDB has contracted to develop projections of manufacturing and mining water demand. The plan of research includes:

- Complete industry surveys to update water use efficiency estimates developed for the 2002 State Water Plan.
- Analyze the impact of technology adoption and input substitution on the relationship of water used to output.
- Develop projections of industry output and associated water use by county.

4.2.4.e Steam Electric Power Generation Water Demands

The TWDB has also contracted with to develop projections of steam electric power generation water demand. The plan of research includes:

- Description of water consuming systems currently used in power generation facilities.
- Estimation of water consumption rates for each identified water consuming system.
- Correlation of current State population with current electric use by region.
- Projection of electric power consumption requirements by county and for the State, based on population projections.
- Identify current and potential water sources for demand by power generation.
- Estimate future water use by power generation.
- Develop and apply allocation methodology to derive demand projections by county.

Criteria for Revision of Water Demand Projections
(as presented in Exhibit B – Guidelines for Regional Water Plan Development)

4.2.5.a Process

Population and water demand projections, for 2010 through 2060, for the State, counties, cities, and county-other (including utility sub-components) will be reviewed through a process coordinated by the Executive Administrator of the TWDB with the Planning Groups, TNRCC, TDA, and the TPWD.

Beginning in January 2002, TWDB will meet on a regular basis with representatives of TNRCC, TPWD, TDA, and the Planning Groups. These meetings will serve to review and achieve consensus, on a county by county basis, on the assumptions (primarily those related to rates of migration) necessary to estimate the future county-level populations that are most likely to occur.

After this process of determining appropriate assumptions is completed, on or about April 30, 2002, the county populations will be distributed among cities, utilities, and county-other. When these distributions are completed, draft population projections for all WUGs will be completed on or about August 2, 2002. Draft water demand projections will be released in the Fall of 2002. The Planning Groups will have the opportunity to review the projections and request revisions through the process described below.

Any entity or rural area (County-Other) wishing to have their respective population or water demand projections revised will address their request through their Planning Group. If the Planning Group agrees with the request, the Planning Group will submit the request to the Executive Administrator of the TWDB along with the data required showing how the entity meets the specific criteria for eligibility for revisions, as specified in these guidelines. Additionally, the proposed revised projections for any specific entity or rural area of a county must accompany the request along with documentation of how the revisions or alternative projections were derived.

Board staff will coordinate the review of each request with the staff of TNRCC, TPWD, and TDA based on specific criteria and data requirements as set forth in these guidelines and will consult the Planning Group and/or their consultant concerning the review of the information. All final population and water demand projections are anticipated to be presented for the approval of the Board in early to mid 2003.

4.2.5.c Municipal Water Use

Municipal water use is defined as residential and commercial water use. Residential use includes single and multi-family residential household water use. Commercial use includes water used by business establishments, public offices, and institutions, but does not include industrial water use. Residential and commercial water uses are categorized together because they are similar types of uses, i.e., each category uses water primarily for drinking, cleaning, sanitation, cooling, and landscape watering. Reported municipal water use data for the year 2000 was used to calculate the base per capita water use for each city. The municipal water demand projections shall incorporate anticipated future water savings due to the natural installation of plumbing fixtures to more water-efficient fixtures, as detailed in the 1991 State Water-Efficient Plumbing Act. All other future water savings due to conservation programs undertaken by cities, utilities or county-other will be classified as WMSs by the Planning Group.

Criteria: One or more of the following criteria must be verified by the Planning Group and the Executive Administrator for consideration of revising the municipal water demand projections:

1. A revision by the Census Bureau of a city's 2000 population will require revision of the city's annual per capita water use.
2. Any changes to the population projections for an entity will require revisions to the municipal water use projections.
3. Errors identified in the reporting of municipal water use for an entity.
4. Evidence that the year 2000 water use was abnormal due to temporary infrastructure constraints.
5. Evidence that per capita water use from a year between 1995-1999 would be more appropriate because that year was more representative of below-normal rainfall conditions.
6. Trends indicating that per capita water use for a city, utility or rural area of a county have increased over the latest period of analysis, beginning in 1990, and evidence that these trends will continue to rise in the short-term future.
7. Evidence that the number of fixture installations to water-efficient fixtures between 1990 and 2000 is different than the TWDB schedule.

Data Requirements: The Planning Group must provide the following data associated with the identified criteria to the Executive Administrator of the TWDB for justifying any revisions to the municipal water use projections:

1) Annual municipal water production (total surface water diversions and/or groundwater pumpage and water purchased from other entities) for an entity measured in acre-feet.
2) The volume of water sales by an entity to other water users (cities, industries, water districts, water supply corporations, etc.) measured in acre-feet.
3) Net annual municipal water use, defined as total water production less sales to other water users (cities, industries, water districts, water supply corporations, etc.) measured in acre-feet.
4) Documentation of temporary infrastructure constraints.
5) Drought index or growing season rainfall data to document a year different than 2000 as the dry year.
6) Documentation of the number of water-efficient fixtures replaced between 1990 and 2000.
7) In order to verify increasing per capita water use trends for a city or rural area of a county and therefore revising projections of per capita water use to reflect this increasing trend, the following data must be provided with the request from the Planning Group:
   a) Historical per capita water use estimates based on net annual municipal water use for the city, utility or rural area of a county, beginning in1990.
   b) A trend analysis which must take into account the variation in annual rainfall.

c) Revised projections of per capita water use for a city, utility or rural area of a county will be submitted by the Planning Group, where an increasing trend in per capita water use has been verified for a city or rural area of a county.

d) Growth data in the residential, commercial and/or public sectors that would justify an increase in per capita water use.

8) Other data the Planning Group believes is important to justify any revisions to the State Water Plan municipal water use projections.

4.2.5.d Industrial Water Use

Industrial water use is defined as water used in the production process of manufactured products, steam-electric power generation, and mining activities, including water used by employees for drinking and sanitation purposes.

Criteria: One or more of the following criteria must be verified by Planning Group and the Executive Administrator for consideration of revising the industrial water use projections:

a. An industrial facility which has recently located in a county and may not have been included in the Board's database. Documentation and analysis must be provided that justify that the new industrial facility will increase the future industrial water use for the county above the industrial water use projections.
b. An industrial facility has recently closed its operation in a county.
c. Plans for the construction of an industrial facility in a county at some future date.

Data Requirements: The Planning Group must provide the following data associated with the identified criteria for justifying any revisions to the industrial water use projections.

1. The quantity of water used on an annual basis by an industrial facility that has recently located in a county and was not included in the Board's database.
2. The North American Industrial Classification (NAIC) of the industrial facility that has recently located in a county. The NAIC is the numerical code for identifying the classification of establishments by type of activity in which they are engaged as defined by the U.S. Office of Management and Budget and is a successor of the Standard Industrial Classification (SIC).
3. Documentation of plans for an industrial facility to locate in a county at some future date will include the following data:
   a. Confirmation of land purchased for the facility or lease arrangements for the facility.
   b. The quantity of water required by the planned facility on an annual basis.
   c. The proposed construction schedule for the facility including the date the facility will become operational.
   d. The NAIC for the planned facility.

4.2.5.e Irrigation Water Use

Irrigation water use will be defined as water used for crop production as defined in the survey of irrigation conducted by the NRCS for the TWDB, in addition to water used for the growth of other plants produced for sale that the Planning Group may be able to identify.

Criteria: One or more of the following criteria must be verified by the Planning Group and the Executive Administrator for consideration of revising the irrigation water use projections:

a) Evidence that a year between 1995-1999 would be more representative of typical irrigated acreage or below-normal rainfall than 2000.
b) Evidence that irrigation water use estimates for a county from another source are more accurate than those used by TWDB.
1. Evidence that the expectation of conditions in the region are such that the projected annual rates of change for irrigation water use in the 2002 State Water Plan are no longer valid.

Data Requirements: The Planning Group must provide the Executive Administrator the following data associated with the identified criteria for justifying any revisions to the irrigation water demand projections:

1) Acreage and water use data for irrigated crops grown in a region, as published by the Texas Agricultural Statistics Service, the Texas Agricultural Extension Service, or the Farm Service Agency (USDA), for the base year 2000 and/or a different year that the Planning Group wishes to present for consideration.
2) Any economic, technical, and/or water supply-related evidence that may show cause for revision in the future rate of change in irrigation water use.

4.2.5.f Livestock Water Use

Livestock water use will be defined as water used in the production of livestock, both for drinking and for cleaning or environmental purposes.

Criteria: One or more of the following criteria must be verified by the Planning Group and the Executive Administrator of the TWDB for consideration of revising the livestock water use projections:

a) Plans for the construction of a confined livestock feeding operation in a county at some future date.
b) Other evidence of change in livestock inventory or water requirements that would justify a revision in the projected future rate of change in livestock water use.

Data Requirements: The Planning Group must provide the following data associated with the identified criteria for justifying any revisions to the livestock water demand projections:

1. Documentation of plans for the construction of a confined livestock feeding facility in a county at some future date will include the following:
   a. Confirmation of land purchase or lease arrangements for the facility.
   b. The construction schedule including the date the livestock feeding facility will become operational.
   c. The daily water requirements of the planned livestock feeding facility.
2. Other evidence that would document an expected increase or decrease in the livestock inventory in the county.

Region D - Water Rights Associated with Water User Group Supply

Region D - North East Texas

Water Right ID	Source Name	Source Region	Source Basin	Water User Group Holding Right	WUG Region	WUG Basin	WUG County
875	BLUNDELL CREEK RUN-OF-RIVER	D	CYPRESS	STEAM ELECTRIC POWER	D	CYPRESS	TITUS
880	CYPRESS RIVER COMBINED RUN-OF-RIVER	D	CYPRESS	COUNTY-OTHER	D	CYPRESS	HARRISON
885	CYPRESS RIVER COMBINED RUN-OF-RIVER	D	CYPRESS	COUNTY-OTHER	D	SABINE	HARRISON
918	CYPRESS RIVER COMBINED RUN-OF-RIVER	D	CYPRESS	GILL WSC	D	SABINE	HARRISON
908	CYPRESS RIVER COMBINED RUN-OF-RIVER	D	CYPRESS	MARSHALL	D	CYPRESS	HARRISON
909	CYPRESS RIVER COMBINED RUN-OF-RIVER	D	CYPRESS	MARSHALL	D	SABINE	HARRISON
930	ELLISON CREEK LAKE/RESERVOIR	D	CYPRESS	MANUFACTURING	D	CYPRESS	MORRIS
946	ELLISON CREEK LAKE/RESERVOIR	D	CYPRESS	STEAM ELECTRIC POWER	D	CYPRESS	MORRIS
894	GILMER LAKE/RESERVOIR	D	CYPRESS	GILMER	D	CYPRESS	UPSHUR
945	GILMER LAKE/RESERVOIR	D	CYPRESS	MANUFACTURING	D	CYPRESS	UPSHUR
876	GRAYS CREEK RUN-OF-RIVER	D	CYPRESS	MANUFACTURING	D	CYPRESS	HARRISON
947	GRAYS CREEK RUN-OF-RIVER	D	CYPRESS	MANUFACTURING	D	SABINE	HARRISON
940	JOHNSON CREEK LAKE/RESERVOIR	D	CYPRESS	STEAM ELECTRIC POWER	D	CYPRESS	MARION
881	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	COUNTY-OTHER	D	CYPRESS	HARRISON
883	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	COUNTY-OTHER	D	CYPRESS	MARION
884	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	COUNTY-OTHER	D	CYPRESS	MORRIS
887	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	COUNTY-OTHER	D	CYPRESS	GREGG
931	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	COUNTY-OTHER	D	CYPRESS	UPSHUR
897	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	DAINGERFIELD	D	CYPRESS	MORRIS
914	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	DIANA WSC	D	CYPRESS	HARRISON
915	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	DIANA WSC	D	CYPRESS	MARION
916	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	DIANA WSC	D	CYPRESS	UPSHUR
895	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	HUGHES SPRINGS	D	CYPRESS	CASS
896	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	HUGHES SPRINGS	D	CYPRESS	MORRIS
913	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	JEFFERSON	D	CYPRESS	MARION
910	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	LONE STAR	D	CYPRESS	MORRIS
899	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	LONGVIEW	D	SABINE	GREGG
902	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	LONGVIEW	D	SABINE	HARRISON
929	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	MANUFACTURING	D	CYPRESS	MORRIS
907	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	ORE CITY	D	CYPRESS	UPSHUR
936	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	STEAM ELECTRIC POWER	D	CYPRESS	MARION
939	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	STEAM ELECTRIC POWER	D	CYPRESS	TITUS

Water Right ID	Source Name	Source Region	Source Basin	Water User Group Holding Right	WUG Region	WUG Basin	WUG County
943	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	STEAM ELECTRIC POWER	D	SABINE	HARRISON
919	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	TRYON ROAD WSC	D	CYPRESS	GREGG
920	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	TRYON ROAD WSC	D	SABINE	GREGG
921	O' THE PINES LAKE/RESERVOIR	D	CYPRESS	TRYON ROAD WSC	D	CYPRESS	HARRISON
938	WELSH LAKE/RESERVOIR	D	CYPRESS	STEAM ELECTRIC POWER	D	CYPRESS	TITUS
941	PAT MAYSE LAKE/RESERVOIR	D	RED	STEAM ELECTRIC POWER	D	RED	LAMAR
932	BIG SANDY CREEK LAKE/RESERVOIR	D	SABINE	COUNTY-OTHER	D	SABINE	UPSHUR
877	BIG SANDY CREEK LAKE/RESERVOIR	D	SABINE	WHITE OAK	D	SABINE	GREGG
942	BRANDY BRANCH LAKE/RESERVOIR	D	SABINE	STEAM ELECTRIC POWER	D	SABINE	HARRISON
900	FORK LAKE/RESERVOIR	D	SABINE	LONGVIEW	D	SABINE	GREGG
903	FORK LAKE/RESERVOIR	D	SABINE	LONGVIEW	D	SABINE	HARRISON
926	FORK LAKE/RESERVOIR	D	SABINE	MANUFACTURING	D	SABINE	HARRISON
937	FORK LAKE/RESERVOIR	D	SABINE	MINING	D	SABINE	HARRISON
879	FORK LAKE/RESERVOIR	D	SABINE	QUITMAN	D	SABINE	WOOD
898	GLADEWATER LAKE/RESERVOIR	D	SABINE	CLARKSVILLE CITY	D	SABINE	GREGG
888	GLADEWATER LAKE/RESERVOIR	D	SABINE	COUNTY-OTHER	D	SABINE	GREGG
933	GLADEWATER LAKE/RESERVOIR	D	SABINE	COUNTY-OTHER	D	SABINE	UPSHUR
935	GLADEWATER LAKE/RESERVOIR	D	SABINE	COUNTY-OTHER	D	SABINE	SMITH
892	GLADEWATER LAKE/RESERVOIR	D	SABINE	GLADEWATER	D	SABINE	GREGG
893	GLADEWATER LAKE/RESERVOIR	D	SABINE	GLADEWATER	D	SABINE	UPSHUR
889	SABINE RIVER COMBINED RUN-OF-RIVER	D	SABINE	COUNTY-OTHER	D	SABINE	GREGG
912	SABINE RIVER COMBINED RUN-OF-RIVER	D	SABINE	KILGORE	D	SABINE	GREGG
901	SABINE RIVER COMBINED RUN-OF-RIVER	D	SABINE	LONGVIEW	D	SABINE	GREGG
904	SABINE RIVER COMBINED RUN-OF-RIVER	D	SABINE	LONGVIEW	D	SABINE	HARRISON
927	SABINE RIVER COMBINED RUN-OF-RIVER	D	SABINE	MANUFACTURING	D	SABINE	HARRISON

Region D - Water Supply by County, WUG, County Other for 2010-2060

Region D - North East Texas

Water User Group Name	Basin	County	Source Name	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060	SELLERS_NAME
BOWIE COUNTY										
DE KALB	RED	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	87	87	87	87	87	87	TEXARKANA CITY OF
HOOKS	RED	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	335	335	335	335	335	335	TEXARKANA CITY OF
NEW BOSTON	RED	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	349	349	349	349	349	349	TEXARKANA CITY OF
TEXARKANA	RED	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	675	706	725	743	738	738	
COUNTY-OTHER	RED	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	430	440	446	452	447	444	
COUNTY-OTHER	RED	BOWIE	CARRIZO-WILCOX AQUIFER	1063	1105	1128	1149	1130	1119	
MANUFACTURING	RED	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	8	9	10	11	12	13	
MINING	RED	BOWIE	OTHER AQUIFER	19	19	18	18	18	18	
IRRIGATION	RED	BOWIE	IRRIGATION LOCAL SUPPLY	2314	2314	2314	2254	2104	1964	
LIVESTOCK	RED	BOWIE	LIVESTOCK LOCAL SUPPLY	120	115	115	105	99	99	
LIVESTOCK	RED	BOWIE	OTHER AQUIFER	42	40	40	36	34	34	
LIVESTOCK	RED	BOWIE	NACATOCH AQUIFER	397	404	404	367	302	240	
LEARY	RED	BOWIE	CARRIZO-WILCOX AQUIFER	85	89	91	94	93	93	
RED LICK	RED	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	86	90	93	95	95	95	TEXARKANA CITY OF
CENTRAL BOWIE WSC	RED	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	88	88	88	88	88	88	TEXARKANA CITY OF
RED RIVER COUNTY WSC	RED	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	4	5	5	5	5	5	TEXARKANA CITY OF
DE KALB	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	336	336	336	336	336	336	TEXARKANA CITY OF
MAUD	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	144	153	161	168	168	168	TEXARKANA CITY OF
NASH	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	303	323	339	355	355	355	TEXARKANA CITY OF
NASH	SULPHUR	BOWIE	CARRIZO-WILCOX AQUIFER	0	0	0	0	0	0	
NEW BOSTON	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	741	741	741	741	741	741	TEXARKANA CITY OF
REDWATER	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	56	56	56	56	56	56	TEXARKANA CITY OF
REDWATER	SULPHUR	BOWIE	CARRIZO-WILCOX AQUIFER	73	73	73	73	73	73	
TEXARKANA	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	5797	6061	6227	6381	6337	6337	
WAKE VILLAGE	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	358	358	358	358	358	358	TEXARKANA CITY OF
COUNTY-OTHER	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	164	164	164	164	164	164	
COUNTY-OTHER	SULPHUR	BOWIE	CARRIZO-WILCOX AQUIFER	2346	2434	2479	2519	2475	2451	
MANUFACTURING	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	2251	2506	2723	2933	3113	3366	
MANUFACTURING	SULPHUR	BOWIE	CARRIZO-WILCOX AQUIFER	28	28	28	28	28	28	
MINING	SULPHUR	BOWIE	CARRIZO-WILCOX AQUIFER	23	22	22	21	21	21	
LIVESTOCK	SULPHUR	BOWIE	LIVESTOCK LOCAL SUPPLY	293	279	279	254	239	239	
LIVESTOCK	SULPHUR	BOWIE	CARRIZO-WILCOX AQUIFER	658	672	672	610	502	396	
RED LICK	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	43	45	46	48	47	47	TEXARKANA CITY OF
CENTRAL BOWIE WSC	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	354	354	354	354	354	354	TEXARKANA CITY OF
MACEDONIA-EYLAU MUD #1	SULPHUR	BOWIE	WRIGHT PATMAN LAKE/RESERVOIR	552	552	552	552	552	552	TEXARKANA CITY OF
CAMP COUNTY										
PITTSBURG	CYPRESS	CAMP	BOB SANDLIN LAKE/RESERVOIR	1928	1925	1923	1921	1919	1916	NORTHEAST TEXAS MWD
PITTSBURG	CYPRESS	CAMP	CARRIZO-WILCOX AQUIFER	481	475	469	464	460	456	
COUNTY-OTHER	CYPRESS	CAMP	CARRIZO-WILCOX AQUIFER	420	432	444	453	461	469	
MANUFACTURING	CYPRESS	CAMP	BOB SANDLIN LAKE/RESERVOIR	42	45	47	49	51	54	

Water User Group Name	Basin	County	Source Name	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060	SELLERS_NAME
MINING	CYPRESS	CAMP	CARRIZO-WILCOX AQUIFER	23	23	23	23	23	23	
LIVESTOCK	CYPRESS	CAMP	LIVESTOCK LOCAL SUPPLY	459	459	459	459	459	459	
LIVESTOCK	CYPRESS	CAMP	CARRIZO-WILCOX AQUIFER	335	335	335	335	335	335	
LIVESTOCK	CYPRESS	CAMP	QUEEN CITY AQUIFER	136	136	136	136	136	136	
BI-COUNTY WSC	CYPRESS	CAMP	CARRIZO-WILCOX AQUIFER	790	790	790	790	790	790	
SHARON WSC	CYPRESS	CAMP	CARRIZO-WILCOX AQUIFER	3	3	3	3	3	3	
SHARON WSC	CYPRESS	CAMP	CARRIZO-WILCOX AQUIFER	9	9	9	10	11	12	
CASS COUNTY										
ATLANTA	CYPRESS	CASS	WRIGHT PATMAN LAKE/RESERVOIR	1876	1876	1876	1876	1876	1876	TEXARKANA CITY OF
HUGHES SPRINGS	CYPRESS	CASS	O' THE PINES LAKE/RESERVOIR	4526	4526	4526	4526	4526	4526	NORTHEAST TEXAS MWD
LINDEN	CYPRESS	CASS	CARRIZO-WILCOX AQUIFER	255	255	255	255	255	255	
QUEEN CITY	CYPRESS	CASS	WRIGHT PATMAN LAKE/RESERVOIR	229	229	229	229	229	229	TEXARKANA CITY OF
QUEEN CITY	CYPRESS	CASS	CARRIZO-WILCOX AQUIFER	169	169	169	169	169	169	
COUNTY-OTHER	CYPRESS	CASS	WRIGHT PATMAN LAKE/RESERVOIR	0	0	0	0	0	0	
COUNTY-OTHER	CYPRESS	CASS	O' THE PINES LAKE/RESERVOIR	1911	1914	1917	1920	1920	1920	
COUNTY-OTHER	CYPRESS	CASS	CARRIZO-WILCOX AQUIFER	1227	1245	1286	1327	1368	1368	
MANUFACTURING	CYPRESS	CASS	O' THE PINES LAKE/RESERVOIR	17	19	20	21	21	23	
MINING	CYPRESS	CASS	QUEEN CITY AQUIFER	326	345	355	364	386	395	
MINING	CYPRESS	CASS	CARRIZO-WILCOX AQUIFER	25	25	25	25	13	13	
LIVESTOCK	CYPRESS	CASS	LIVESTOCK LOCAL SUPPLY	565	565	565	565	565	565	
LIVESTOCK	CYPRESS	CASS	CARRIZO-WILCOX AQUIFER	19	19	19	19	19	19	
IRRIGATION	CYPRESS	CASS	QUEEN CITY AQUIFER	6	6	6	6	6	6	
ATLANTA	SULPHUR	CASS	WRIGHT PATMAN LAKE/RESERVOIR	2	2	2	2	2	2	TEXARKANA CITY OF
QUEEN CITY	SULPHUR	CASS	WRIGHT PATMAN LAKE/RESERVOIR	135	135	135	135	135	135	TEXARKANA CITY OF
QUEEN CITY	SULPHUR	CASS	CARRIZO-WILCOX AQUIFER	100	100	100	100	100	100	
COUNTY-OTHER	SULPHUR	CASS	WRIGHT PATMAN LAKE/RESERVOIR	44	44	44	44	44	44	
COUNTY-OTHER	SULPHUR	CASS	CARRIZO-WILCOX AQUIFER	1154	1172	1212	1253	1294	1294	
MANUFACTURING	SULPHUR	CASS	WRIGHT PATMAN LAKE/RESERVOIR	107397	115160	121315	127196	132283	141256	
MANUFACTURING	SULPHUR	CASS	CARRIZO-WILCOX AQUIFER	20	20	20	20	20	20	
MINING	SULPHUR	CASS	CARRIZO-WILCOX AQUIFER	20	20	20	20	20	20	
MINING	SULPHUR	CASS	QUEEN CITY AQUIFER	437	461	474	487	498	511	
LIVESTOCK	SULPHUR	CASS	CARRIZO-WILCOX AQUIFER	20	20	20	20	20	20	
LIVESTOCK	SULPHUR	CASS	QUEEN CITY AQUIFER	230	230	230	230	230	230	
DELTA COUNTY										
COOPER	SULPHUR	DELTA	CHAPMAN/COOPER LAKE/RESERVOIR NON-SYSTEM PORTION	710	690	669	647	623	591	SULPHUR RIVER MWD
COOPER	SULPHUR	DELTA	BIG CREEK LAKE/RESERVOIR	980	980	980	980	980	980	
COUNTY-OTHER	SULPHUR	DELTA	BIG CREEK LAKE/RESERVOIR	453	460	467	477	477	477	
COUNTY-OTHER	SULPHUR	DELTA	TAWAKONI LAKE/RESERVOIR	74	74	74	74	74	74	
COUNTY-OTHER	SULPHUR	DELTA	TRINITY AQUIFER	85	85	0	0	0	0	
COUNTY-OTHER	SULPHUR	DELTA	WOODBINE AQUIFER	10	10	11	12	12	12	
IRRIGATION	SULPHUR	DELTA	IRRIGATION LOCAL SUPPLY	416	416	416	416	416	416	
IRRIGATION	SULPHUR	DELTA	NACATOCH AQUIFER	5	38	51	61	66	66	

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IRRIGATION	SULPHUR	DELTA	TRINITY AQUIFER	157	118	99	82	71	65	
LIVESTOCK	SULPHUR	DELTA	LIVESTOCK LOCAL SUPPLY	202	202	202	202	202	202	
LIVESTOCK	SULPHUR	DELTA	NACATOCH AQUIFER	20	20	20	20	20	20	
LIVESTOCK	SULPHUR	DELTA	TRINITY AQUIFER	122	122	122	122	122	122	
NORTH HUNT WSC	SULPHUR	DELTA	TAWAKONI LAKE/RESERVOIR	28	32	36	40	41	42	COMMERCE WD
NORTH HUNT WSC	SULPHUR	DELTA	WOODBINE AQUIFER	6	5	4	3	2	1	
FRANKLIN COUNTY										
WINNSBORO	CYPRESS	FRANKLIN	CYPRESS SPRINGS LAKE/RESERVOIR	971	971	971	971	971	971	FRANKLIN COUNTY WD
COUNTY-OTHER	CYPRESS	FRANKLIN	CYPRESS SPRINGS LAKE/RESERVOIR	81	81	81	81	81	81	
COUNTY-OTHER	CYPRESS	FRANKLIN	CARRIZO-WILCOX AQUIFER	55	62	67	72	72	72	
MINING	CYPRESS	FRANKLIN	CARRIZO-WILCOX AQUIFER	651	621	607	593	582	570	
LIVESTOCK	CYPRESS	FRANKLIN	LIVESTOCK LOCAL SUPPLY	291	291	291	291	291	291	
LIVESTOCK	CYPRESS	FRANKLIN	CARRIZO-WILCOX AQUIFER	133	133	133	133	133	133	
CYPRESS SPRINGS WSC	CYPRESS	FRANKLIN	CYPRESS SPRINGS LAKE/RESERVOIR	2412	2412	2412	2412	2412	2412	FRANKLIN COUNTY WD
CYPRESS SPRINGS WSC	CYPRESS	FRANKLIN	CARRIZO-WILCOX AQUIFER	67	67	67	67	67	67	
TRI WSC	CYPRESS	FRANKLIN	BOB SANDLIN LAKE/RESERVOIR	21	24	27	29	29	29	MOUNT PLEASANT CITY O
LIVESTOCK	SABINE	FRANKLIN	LIVESTOCK LOCAL SUPPLY	1	1	1	1	1	1	
MOUNT VERNON	SULPHUR	FRANKLIN	CYPRESS SPRINGS LAKE/RESERVOIR	3000	3000	3000	3000	3000	3000	FRANKLIN COUNTY WD
COUNTY-OTHER	SULPHUR	FRANKLIN	BOB SANDLIN LAKE/RESERVOIR	12	14	16	17	17	17	
COUNTY-OTHER	SULPHUR	FRANKLIN	CARRIZO-WILCOX AQUIFER	104	121	133	143	143	143	
MINING	SULPHUR	FRANKLIN	CARRIZO-WILCOX AQUIFER	439	419	409	401	392	384	
LIVESTOCK	SULPHUR	FRANKLIN	LIVESTOCK LOCAL SUPPLY	469	469	469	469	469	469	
LIVESTOCK	SULPHUR	FRANKLIN	CARRIZO-WILCOX AQUIFER	228	228	228	228	228	228	
CYPRESS SPRINGS WSC	SULPHUR	FRANKLIN	CYPRESS SPRINGS LAKE/RESERVOIR	393	393	393	393	393	393	FRANKLIN COUNTY WD
NORTH HOPKINS WSC	SULPHUR	FRANKLIN	CHAPMAN/COOPER LAKE/RESERVOIR NON-SYSTEM PORTION	9	11	12	13	13	13	SULPHUR SPRINGS CITY O
GREGG COUNTY										
COUNTY-OTHER	CYPRESS	GREGG	O' THE PINES LAKE/RESERVOIR	38	38	38	38	38	38	NORTHEAST TEXAS MWD
COUNTY-OTHER	CYPRESS	GREGG	CARRIZO-WILCOX AQUIFER	186	196	207	220	237	261	
COUNTY-OTHER	CYPRESS	GREGG	CARRIZO-WILCOX AQUIFER	19	19	19	19	19	19	
LIVESTOCK	CYPRESS	GREGG	CARRIZO-WILCOX AQUIFER	31	31	31	31	31	31	
TRYON ROAD WSC	CYPRESS	GREGG	O' THE PINES LAKE/RESERVOIR	1709	1709	1709	1709	1709	1709	NORTHEAST TEXAS MWD
TRYON ROAD WSC	CYPRESS	GREGG	CARRIZO-WILCOX AQUIFER	275	275	275	275	275	275	
CLARKSVILLE CITY	SABINE	GREGG	GLADEWATER LAKE/RESERVOIR	257	0	0	0	0	0	
GLADEWATER	SABINE	GREGG	GLADEWATER LAKE/RESERVOIR	772	772	772	772	772	772	
KILGORE	SABINE	GREGG	SABINE RIVER COMBINED RUN-OF-RIVER	2588	2588	2588	2588	2588	2588	SABINE RIVER AUTHORIT
KILGORE	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	927	927	927	927	927	927	
LAKEPORT	SABINE	GREGG	CHEROKEE LAKE/RESERVOIR	112	112	112	112	112	112	
LAKEPORT	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	341	341	341	341	341	341	
LONGVIEW	SABINE	GREGG	O' THE PINES LAKE/RESERVOIR	15000	15000	15000	15000	15000	15000	
LONGVIEW	SABINE	GREGG	FORK LAKE/RESERVOIR	15000	15000	15000	15000	15000	15000	

Water User Group Name	Basin	County	Source Name	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060	SELLERS_NAME
LONGVIEW	SABINE	GREGG	SABINE RIVER COMBINED RUN-OF-RIVER	14502	14502	14502	14502	14502	14502	
LONGVIEW	SABINE	GREGG	CHEROKEE LAKE/RESERVOIR	3500	3500	3500	3500	3500	3500	
WHITE OAK	SABINE	GREGG	BIG SANDY CREEK LAKE/RESERVOIR	3171	3171	3171	3171	3171	3171	LONGVIEW CITY OF
COUNTY-OTHER	SABINE	GREGG	GLADEWATER LAKE/RESERVOIR	354	354	354	354	354	354	
COUNTY-OTHER	SABINE	GREGG	SABINE RIVER COMBINED RUN-OF-RIVER	249	249	249	249	249	249	
COUNTY-OTHER	SABINE	GREGG	CHEROKEE LAKE/RESERVOIR	18	18	18	18	18	18	
COUNTY-OTHER	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	694	758	825	903	1008	1160	
COUNTY-OTHER	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	18	18	18	18	18	18	
MANUFACTURING	SABINE	GREGG	OTHER LOCAL SUPPLY	450	450	450	450	450	450	
MANUFACTURING	SABINE	GREGG	CHEROKEE LAKE/RESERVOIR	1943	2273	2572	2865	3117	3424	
MANUFACTURING	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	30	30	30	30	30	30	
STEAM ELECTRIC POWER	SABINE	GREGG	CHEROKEE LAKE/RESERVOIR	2000	2000	2000	2000	2000	2000	
MINING	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	58	70	79	88	98	107	
LIVESTOCK	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	208	208	208	208	208	208	
EASTON	SABINE	GREGG	CHEROKEE LAKE/RESERVOIR	59	59	59	59	59	59	
EASTON	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	179	179	179	179	179	179	
ELDERVILLE WSC	SABINE	GREGG	CHEROKEE LAKE/RESERVOIR	364	364	364	364	364	364	
ELDERVILLE WSC	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	1106	1106	1106	1106	1106	1106	
LIBERTY CITY WSC	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	482	482	482	482	482	482	
TRYON ROAD WSC	SABINE	GREGG	O' THE PINES LAKE/RESERVOIR	941	941	941	941	941	941	NORTHEAST TEXAS MWD
TRYON ROAD WSC	SABINE	GREGG	CHEROKEE LAKE/RESERVOIR	429	429	429	429	429	429	LONGVIEW CITY OF
TRYON ROAD WSC	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	221	221	221	221	221	221	
WEST GREGG WSC	SABINE	GREGG	CARRIZO-WILCOX AQUIFER	365	365	365	365	365	365	
HARRISON COUNTY										
MARSHALL	CYPRESS	HARRISON	CYPRESS RIVER COMBINED RUN-OF-RIVER	2360	2369	2374	2370	2366	2359	
WASKOM	CYPRESS	HARRISON	CARRIZO-WILCOX AQUIFER	324	324	324	324	324	324	
COUNTY-OTHER	CYPRESS	HARRISON	CYPRESS RIVER COMBINED RUN-OF-RIVER	362	362	362	362	362	362	
COUNTY-OTHER	CYPRESS	HARRISON	O' THE PINES LAKE/RESERVOIR	146	146	146	146	146	146	
COUNTY-OTHER	CYPRESS	HARRISON	CHEROKEE LAKE/RESERVOIR	54	54	54	54	54	54	
COUNTY-OTHER	CYPRESS	HARRISON	CARRIZO-WILCOX AQUIFER	15	15	15	15	15	15	
COUNTY-OTHER	CYPRESS	HARRISON	CARRIZO-WILCOX AQUIFER	2431	2557	2647	2716	2796	2914	
COUNTY-OTHER	CYPRESS	HARRISON	CARRIZO-WILCOX AQUIFER	30	30	30	30	30	30	
MANUFACTURING	CYPRESS	HARRISON	CARRIZO-WILCOX AQUIFER	11	12	13	14	15	17	
MINING	CYPRESS	HARRISON	QUEEN CITY AQUIFER	46	7	0	0	0	0	
MINING	CYPRESS	HARRISON	CARRIZO-WILCOX AQUIFER	163	217	233	241	250	257	
IRRIGATION	CYPRESS	HARRISON	IRRIGATION LOCAL SUPPLY	28	28	28	28	28	28	
IRRIGATION	CYPRESS	HARRISON	CARRIZO-WILCOX AQUIFER	25	25	25	25	25	25	
LIVESTOCK	CYPRESS	HARRISON	LIVESTOCK LOCAL SUPPLY	366	366	366	366	366	366	
LIVESTOCK	CYPRESS	HARRISON	QUEEN CITY AQUIFER	26	26	26	26	26	26	
LIVESTOCK	CYPRESS	HARRISON	CARRIZO-WILCOX AQUIFER	140	167	196	225	255	287	

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DIANA WSC	CYPRESS	HARRISON	O' THE PINES LAKE/RESERVOIR	52	52	52	52	52	52	NORTHEAST TEXAS MWD
DIANA WSC	CYPRESS	HARRISON	CARRIZO-WILCOX AQUIFER	48	48	48	48	48	48	
GUM SPRINGS WSC	CYPRESS	HARRISON	CHEROKEE LAKE/RESERVOIR	109	109	109	109	109	109	LONGVIEW CITY OF
GUM SPRINGS WSC	CYPRESS	HARRISON	CARRIZO-WILCOX AQUIFER	31	31	31	31	31	31	
TRYON ROAD WSC	CYPRESS	HARRISON	O' THE PINES LAKE/RESERVOIR	147	147	147	147	147	147	NORTHEAST TEXAS MWD
TRYON ROAD WSC	CYPRESS	HARRISON	CHEROKEE LAKE/RESERVOIR	67	67	67	67	67	67	LONGVIEW CITY OF
TRYON ROAD WSC	CYPRESS	HARRISON	CARRIZO-WILCOX AQUIFER	34	34	34	34	34	34	
HALLSVILLE	SABINE	HARRISON	CHEROKEE LAKE/RESERVOIR	737	737	737	737	737	737	
HALLSVILLE	SABINE	HARRISON	CARRIZO-WILCOX AQUIFER	142	142	142	142	142	142	
LONGVIEW	SABINE	HARRISON	O' THE PINES LAKE/RESERVOIR	5000	5000	5000	5000	5000	5000	
LONGVIEW	SABINE	HARRISON	FORK LAKE/RESERVOIR	5000	5000	5000	5000	5000	5000	
LONGVIEW	SABINE	HARRISON	SABINE RIVER COMBINED RUN-OF-RIVER	4834	4834	4834	4834	4834	4834	
LONGVIEW	SABINE	HARRISON	CHEROKEE LAKE/RESERVOIR	10400	10400	10400	10400	10400	10400	
MARSHALL	SABINE	HARRISON	CYPRESS RIVER COMBINED RUN-OF-RIVER	8383	8418	8440	8424	8405	8376	
COUNTY-OTHER	SABINE	HARRISON	CYPRESS RIVER COMBINED RUN-OF-RIVER	100	100	100	100	100	100	
COUNTY-OTHER	SABINE	HARRISON	CHEROKEE LAKE/RESERVOIR	328	328	328	328	328	328	
COUNTY-OTHER	SABINE	HARRISON	CARRIZO-WILCOX AQUIFER	669	725	766	796	832	884	
MANUFACTURING	SABINE	HARRISON	GRAYS CREEK RUN-OF-RIVER	0	0	0	0	0	0	
MANUFACTURING	SABINE	HARRISON	FORK LAKE/RESERVOIR	5524	5524	5524	5524	5524	5524	
MANUFACTURING	SABINE	HARRISON	SABINE RIVER COMBINED RUN-OF-RIVER	134500	134500	134500	134500	134500	134500	
STEAM ELECTRIC POWER	SABINE	HARRISON	O' THE PINES LAKE/RESERVOIR	18000	18000	18000	18000	18000	18000	
STEAM ELECTRIC POWER	SABINE	HARRISON	BRANDY BRANCH LAKE/RESERVOIR	1270	1270	1270	1270	1270	1270	
STEAM ELECTRIC POWER	SABINE	HARRISON	DIRECT REUSE	6161	6161	6161	6161	6161	6161	
MINING	SABINE	HARRISON	FORK LAKE/RESERVOIR	140	140	140	140	140	140	
MINING	SABINE	HARRISON	CARRIZO-WILCOX AQUIFER	81	96	105	115	124	132	
IRRIGATION	SABINE	HARRISON	IRRIGATION LOCAL SUPPLY	39	39	39	39	39	39	
IRRIGATION	SABINE	HARRISON	CARRIZO-WILCOX AQUIFER	14	14	14	14	14	14	
LIVESTOCK	SABINE	HARRISON	CARRIZO-WILCOX AQUIFER	386	405	425	447	469	492	
GILL WSC	SABINE	HARRISON	CYPRESS RIVER COMBINED RUN-OF-RIVER	100	100	100	100	100	100	
GILL WSC	SABINE	HARRISON	CARRIZO-WILCOX AQUIFER	231	231	231	231	231	231	
GUM SPRINGS WSC	SABINE	HARRISON	CHEROKEE LAKE/RESERVOIR	797	797	797	797	797	797	LONGVIEW CITY OF
GUM SPRINGS WSC	SABINE	HARRISON	CARRIZO-WILCOX AQUIFER	232	232	232	232	232	232	
HOPKINS COUNTY										
COUNTY-OTHER	CYPRESS	HOPKINS	CARRIZO-WILCOX AQUIFER	3	4	4	3	3	3	
COUNTY-OTHER	CYPRESS	HOPKINS	CARRIZO-WILCOX AQUIFER	175	175	175	175	175	175	
LIVESTOCK	CYPRESS	HOPKINS	LIVESTOCK LOCAL SUPPLY	108	108	108	108	108	108	
LIVESTOCK	CYPRESS	HOPKINS	CARRIZO-WILCOX AQUIFER	38	38	38	38	38	38	
CYPRESS SPRINGS WSC	CYPRESS	HOPKINS	CYPRESS SPRINGS LAKE/RESERVOIR	441	441	441	441	441	441	FRANKLIN COUNTY WD
SHARON WSC	CYPRESS	HOPKINS	CARRIZO-WILCOX AQUIFER	3	3	3	3	3	3	

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SHARON WSC	CYPRESS	HOPKINS	CARRIZO-WILCOX AQUIFER	9	9	9	9	9	9	
CUMBY	SABINE	HOPKINS	NACATOCH AQUIFER	88	95	100	104	103	103	
COUNTY-OTHER	SABINE	HOPKINS	CHAPMAN/COOPER LAKE/RESERVOIR NON-SYSTEM PORTION	193	213	222	227	208	191	
COUNTY-OTHER	SABINE	HOPKINS	CARRIZO-WILCOX AQUIFER	389	392	393	394	392	389	
COUNTY-OTHER	SABINE	HOPKINS	CARRIZO-WILCOX AQUIFER	112	112	112	112	112	112	
COUNTY-OTHER	SABINE	HOPKINS	CARRIZO-WILCOX AQUIFER	5	5	5	5	5	5	
LIVESTOCK	SABINE	HOPKINS	LIVESTOCK LOCAL SUPPLY	1208	1208	1208	1208	1208	1208	
LIVESTOCK	SABINE	HOPKINS	CARRIZO-WILCOX AQUIFER	249	249	249	249	249	249	
COMO	SABINE	HOPKINS	CARRIZO-WILCOX AQUIFER	113	112	109	107	107	107	
CASH SUD	SABINE	HOPKINS	TAWAKONI LAKE/RESERVOIR	45	51	54	56	52	48	SABINE RIVER AUTHORIT
COMO	SULPHUR	HOPKINS	CARRIZO-WILCOX AQUIFER	30	31	34	36	36	36	
SULPHUR SPRINGS	SULPHUR	HOPKINS	CHAPMAN/COOPER LAKE/RESERVOIR NON-SYSTEM PORTION	11525	11260	11041	10836	10750	10609	
SULPHUR SPRINGS	SULPHUR	HOPKINS	SULPHUR SPRINGS LAKE/RESERVOIR	7344	7215	7081	6858	6802	6529	
COUNTY-OTHER	SULPHUR	HOPKINS	CHAPMAN/COOPER LAKE/RESERVOIR NON-SYSTEM PORTION	155	174	183	189	169	150	
COUNTY-OTHER	SULPHUR	HOPKINS	NACATOCH AQUIFER	161	166	143	140	139	137	
COUNTY-OTHER	SULPHUR	HOPKINS	CARRIZO-WILCOX AQUIFER	121	124	126	127	123	120	
COUNTY-OTHER	SULPHUR	HOPKINS	CARRIZO-WILCOX AQUIFER	269	269	269	269	269	269	
MANUFACTURING	SULPHUR	HOPKINS	SULPHUR SPRINGS LAKE/RESERVOIR	1039	1111	1168	1222	1268	1357	
MINING	SULPHUR	HOPKINS	OTHER AQUIFER	175	189	197	205	213	221	
LIVESTOCK	SULPHUR	HOPKINS	LIVESTOCK LOCAL SUPPLY	1627	1570	1493	1324	1314	1130	
LIVESTOCK	SULPHUR	HOPKINS	SULPHUR SPRINGS LAKE/RESERVOIR	1417	1474	1551	1720	1730	1914	
LIVESTOCK	SULPHUR	HOPKINS	OTHER AQUIFER	77	77	77	77	77	77	
LIVESTOCK	SULPHUR	HOPKINS	CARRIZO-WILCOX AQUIFER	133	133	133	133	133	133	
CUMBY	SULPHUR	HOPKINS	NACATOCH AQUIFER	52	45	40	36	37	37	
CYPRESS SPRINGS WSC	SULPHUR	HOPKINS	CYPRESS SPRINGS LAKE/RESERVOIR	72	72	72	72	72	72	FRANKLIN COUNTY WD
MARTIN SPRINGS WSC	SULPHUR	HOPKINS	CHAPMAN/COOPER LAKE/RESERVOIR NON-SYSTEM PORTION	223	223	223	223	223	223	SULPHUR SPRINGS CITY C
MARTIN SPRINGS WSC	SULPHUR	HOPKINS	CARRIZO-WILCOX AQUIFER	454	454	454	454	454	454	
NORTH HOPKINS WSC	SULPHUR	HOPKINS	CHAPMAN/COOPER LAKE/RESERVOIR NON-SYSTEM PORTION	631	708	754	784	724	663	SULPHUR SPRINGS CITY C
IRRIGATION	SULPHUR	HOPKINS	CARRIZO-WILCOX AQUIFER	50	50	50	50	50	50	
HUNT COUNTY										
CADDO MILLS	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	174	178	186	201	242	309	GREENVILLE CITY OF
CAMPBELL	SABINE	HUNT	NACATOCH AQUIFER	109	109	111	123	149	189	
CELESTE	SABINE	HUNT	WOODBINE AQUIFER	161	161	161	161	161	161	
GREENVILLE	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	18890	18572	18243	17890	17523	17179	SABINE RIVER AUTHORIT
GREENVILLE	SABINE	HUNT	GREENVILLE CITY LAKE/RESERVOIR	3486	3486	3486	3486	3486	3486	
LONE OAK	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	164	164	164	164	164	164	CASH WSC
QUINLAN	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	605	605	605	605	605	605	CASH WSC
WEST TAWAKONI	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	1080	1072	1064	1056	1047	1039	SABINE RIVER AUTHORIT

Water User Group Name	Basin	County	Source Name	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060	SELLERS_NAME
COUNTY-OTHER	SABINE	HUNT	LAVON LAKE/RESERVOIR NORTH TEXAS MWD SYSTEM	261	321	409	556	883	1397	
COUNTY-OTHER	SABINE	HUNT	TERRELL LAKE/RESERVOIR	28	29	32	39	57	80	
COUNTY-OTHER	SABINE	HUNT	BIG CREEK LAKE/RESERVOIR	4	4	6	8	12	19	
COUNTY-OTHER	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	1102	1103	1107	1116	1139	1169	
COUNTY-OTHER	SABINE	HUNT	NACATOCH AQUIFER	248	248	248	248	248	248	
COUNTY-OTHER	SABINE	HUNT	WOODBINE AQUIFER	29	29	29	29	29	29	
MANUFACTURING	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	532	694	862	1043	1216	1335	
MANUFACTURING	SABINE	HUNT	TRINITY AQUIFER	200	200	200	200	200	200	
MINING	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	20	19	20	23	24	29	
MINING	SABINE	HUNT	TRINITY AQUIFER	37	36	34	30	28	22	
IRRIGATION	SABINE	HUNT	IRRIGATION LOCAL SUPPLY	1386	1386	1386	1386	1386	1386	
IRRIGATION	SABINE	HUNT	TRINITY AQUIFER	106	106	106	106	106	106	
LIVESTOCK	SABINE	HUNT	LIVESTOCK LOCAL SUPPLY	812	812	812	812	812	812	
JOSEPHINE	SABINE	HUNT	LAVON LAKE/RESERVOIR NORTH TEXAS MWD SYSTEM	3	3	4	4	6	8	NORTH TEXAS MWD
ABLE SPRINGS WSC	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	119	119	119	119	119	119	SABINE RIVER AUTHORIT
BLACKLAND WSC	SABINE	HUNT	LAVON LAKE/RESERVOIR NORTH TEXAS MWD SYSTEM	4	5	7	9	14	23	ROCKWALL CITY OF
CADDO BASIN SUD	SABINE	HUNT	LAVON LAKE/RESERVOIR NORTH TEXAS MWD SYSTEM	597	738	942	1279	2033	3214	NORTH TEXAS MWD
CASH SUD	SABINE	HUNT	LAVON LAKE/RESERVOIR NORTH TEXAS MWD SYSTEM	1222	943	808	667	594	530	NORTH TEXAS MWD
CASH SUD	SABINE	HUNT	FORK LAKE/RESERVOIR	2240	2240	2240	2240	2240	2240	SABINE RIVER AUTHORIT
CASH SUD	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	2409	2386	2371	2366	2371	2377	SABINE RIVER AUTHORIT
COMBINED CONSUMERS WSC	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	1419	1390	1348	1312	1271	1226	SABINE RIVER AUTHORIT
COMMUNITY WATER COMPANY	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	189	189	189	189	189	189	EMORY CITY OF
HICKORY CREEK SUD	SABINE	HUNT	WOODBINE AQUIFER	75	75	75	75	75	75	
MAC BEE WSC	SABINE	HUNT	TAWAKONI LAKE/RESERVOIR	109	109	109	112	178	281	SABINE RIVER AUTHORIT
CAMPBELL WSC	SABINE	HUNT	NACATOCH AQUIFER	28	28	26	14	0	0	
COMMERCE	SULPHUR	HUNT	CHAPMAN/COOPER LAKE/RESERVOIR NON-SYSTEM PORTION	0	0	0	0	0	0	
COMMERCE	SULPHUR	HUNT	TAWAKONI LAKE/RESERVOIR	7676	7541	7383	7173	6731	6074	SABINE RIVER AUTHORIT
COMMERCE	SULPHUR	HUNT	NACATOCH AQUIFER	196	196	196	196	196	196	
COMMERCE	SULPHUR	HUNT	NACATOCH AQUIFER	175	175	175	175	175	175	
WOLFE CITY	SULPHUR	HUNT	OTHER LOCAL SUPPLY	140	140	120	120	120	120	
COUNTY-OTHER	SULPHUR	HUNT	TAWAKONI LAKE/RESERVOIR	69	143	241	390	771	1369	
COUNTY-OTHER	SULPHUR	HUNT	WOODBINE AQUIFER	116	150	196	265	442	717	
COUNTY-OTHER	SULPHUR	HUNT	NACATOCH AQUIFER	290	290	290	290	290	290	
MANUFACTURING	SULPHUR	HUNT	TAWAKONI LAKE/RESERVOIR	277	338	401	470	535	580	
LIVESTOCK	SULPHUR	HUNT	LIVESTOCK LOCAL SUPPLY	300	300	300	300	300	300	
HICKORY CREEK SUD	SULPHUR	HUNT	WOODBINE AQUIFER	176	178	180	183	187	189	
NORTH HUNT WSC	SULPHUR	HUNT	TAWAKONI LAKE/RESERVOIR	119	115	111	107	106	105	COMMERCE WD

Water User Group Name	Basin	County	Source Name	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060	SELLERS_NAME
NORTH HUNT WSC	SULPHUR	HUNT	WOODBINE AQUIFER	0	0	0	0	0	0	
NORTH HUNT WSC	SULPHUR	HUNT	TRINITY AQUIFER	18	18	18	18	18	0	
NORTH HUNT WSC	SULPHUR	HUNT	WOODBINE AQUIFER	56	57	58	59	60	61	
CAMPBELL WSC	SULPHUR	HUNT	NACATOCH AQUIFER	41	41	41	41	29	0	
IRRIGATION	SULPHUR	HUNT	SULPHUR RIVER COMBINED RUN-OF-RIVER	446	446	446	446	446	446	
COUNTY-OTHER	TRINITY	HUNT	WOODBINE AQUIFER	5	5	5	5	5	5	
COUNTY-OTHER	TRINITY	HUNT	WOODBINE AQUIFER	19	24	30	39	60	95	
LIVESTOCK	TRINITY	HUNT	LIVESTOCK LOCAL SUPPLY	5	5	5	5	5	6	
LIVESTOCK	TRINITY	HUNT	TRINITY AQUIFER	4	4	4	4	4	3	
CADDO BASIN SUD	TRINITY	HUNT	LAVON LAKE/RESERVOIR NORTH TEXAS MWD SYSTEM	6	7	9	12	20	32	NORTH TEXAS MWD
HICKORY CREEK SUD	TRINITY	HUNT	WOODBINE AQUIFER	74	72	73	76	82	86	
LAMAR COUNTY										
BLOSSOM	RED	LAMAR	PAT MAYSE LAKE/RESERVOIR	201	216	230	245	245	245	LAMAR COUNTY WSD
PARIS	RED	LAMAR	PAT MAYSE LAKE/RESERVOIR	10533	10164	9926	9691	9475	9171	
PARIS	RED	LAMAR	CROOK LAKE/RESERVOIR	400	400	400	400	400	400	
RENO	RED	LAMAR	PAT MAYSE LAKE/RESERVOIR	102	115	128	138	149	160	LAMAR COUNTY WSD
COUNTY-OTHER	RED	LAMAR	PAT MAYSE LAKE/RESERVOIR	5	5	6	6	6	6	
COUNTY-OTHER	RED	LAMAR	TRINITY AQUIFER	56	59	62	65	64	62	
COUNTY-OTHER	RED	LAMAR	WOODBINE AQUIFER	17	17	0	0	0	0	
MANUFACTURING	RED	LAMAR	PAT MAYSE LAKE/RESERVOIR	805	858	900	941	976	1042	
STEAM ELECTRIC POWER	RED	LAMAR	PAT MAYSE LAKE/RESERVOIR	8961	8961	8961	8961	8961	8961	
MINING	RED	LAMAR	TRINITY AQUIFER	8	8	8	8	8	8	
IRRIGATION	RED	LAMAR	IRRIGATION LOCAL SUPPLY	3016	3017	3016	3016	3016	3016	
IRRIGATION	RED	LAMAR	TRINITY AQUIFER	533	533	533	475	475	413	
IRRIGATION	RED	LAMAR	WOODBINE AQUIFER	2154	2090	2028	2023	1961	1962	
LIVESTOCK	RED	LAMAR	TRINITY AQUIFER	264	264	264	235	235	192	
LIVESTOCK	RED	LAMAR	WOODBINE AQUIFER	1370	1370	1370	1399	1399	1442	
LAMAR COUNTY WSD	RED	LAMAR	PAT MAYSE LAKE/RESERVOIR	1400	1400	1400	1400	1400	1400	PARIS CITY OF
DEPORT	SULPHUR	LAMAR	PAT MAYSE LAKE/RESERVOIR	93	100	106	113	113	113	LAMAR COUNTY WSD
PARIS	SULPHUR	LAMAR	PAT MAYSE LAKE/RESERVOIR	15800	15246	14889	14537	14213	13757	
PARIS	SULPHUR	LAMAR	CROOK LAKE/RESERVOIR	600	600	600	600	600	600	
ROXTON	SULPHUR	LAMAR	PAT MAYSE LAKE/RESERVOIR	97	104	111	118	118	118	LAMAR COUNTY WSD
COUNTY-OTHER	SULPHUR	LAMAR	PAT MAYSE LAKE/RESERVOIR	265	269	274	279	277	275	
COUNTY-OTHER	SULPHUR	LAMAR	TRINITY AQUIFER	46	48	50	53	52	51	
MANUFACTURING	SULPHUR	LAMAR	PAT MAYSE LAKE/RESERVOIR	4775	5091	5340	5580	5787	6183	
MINING	SULPHUR	LAMAR	TRINITY AQUIFER	8	7	7	7	7	7	
LIVESTOCK	SULPHUR	LAMAR	LIVESTOCK LOCAL SUPPLY	808	808	808	823	823	848	
LIVESTOCK	SULPHUR	LAMAR	TRINITY AQUIFER	151	151	151	136	136	111	
RENO	SULPHUR	LAMAR	PAT MAYSE LAKE/RESERVOIR	455	513	571	616	665	713	LAMAR COUNTY WSD
LAMAR COUNTY WSD	SULPHUR	LAMAR	PAT MAYSE LAKE/RESERVOIR	6861	6822	6784	6751	6728	6704	PARIS CITY OF
MARION COUNTY										

Water User Group Name	Basin	County	Source Name	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060	SELLERS_NAME
JEFFERSON	CYPRESS	MARION	CYPRESS RIVER COMBINED RUN-OF-RIVER	1287	1287	1287	1287	1287	1287	
JEFFERSON	CYPRESS	MARION	O' THE PINES LAKE/RESERVOIR	9760	9760	9760	9760	9760	9760	NORTHEAST TEXAS MWD
COUNTY-OTHER	CYPRESS	MARION	O' THE PINES LAKE/RESERVOIR	804	804	804	804	804	804	
COUNTY-OTHER	CYPRESS	MARION	CARRIZO-WILCOX AQUIFER	1539	1547	1547	1547	1547	1547	
COUNTY-OTHER	CYPRESS	MARION	CARRIZO-WILCOX AQUIFER	35	35	35	35	35	0	
MANUFACTURING	CYPRESS	MARION	CARRIZO-WILCOX AQUIFER	65	72	76	79	83	89	
STEAM ELECTRIC POWER	CYPRESS	MARION	O' THE PINES LAKE/RESERVOIR	6668	6668	6668	6668	6668	6668	
STEAM ELECTRIC POWER	CYPRESS	MARION	JOHNSON CREEK LAKE/RESERVOIR	1785	1785	1785	1785	1785	1785	
MINING	CYPRESS	MARION	CARRIZO-WILCOX AQUIFER	111	116	119	122	124	126	
LIVESTOCK	CYPRESS	MARION	QUEEN CITY AQUIFER	1833	1833	1833	1833	1833	1833	
LIVESTOCK	CYPRESS	MARION	CARRIZO-WILCOX AQUIFER	130	130	130	130	130	130	
DIANA WSC	CYPRESS	MARION	O' THE PINES LAKE/RESERVOIR	29	29	29	29	29	29	NORTHEAST TEXAS MWD
DIANA WSC	CYPRESS	MARION	CARRIZO-WILCOX AQUIFER	27	27	27	27	27	27	
IRRIGATION	CYPRESS	MARION	CARRIZO-WILCOX AQUIFER	68	68	68	68	68	68	
MORRIS COUNTY										
DAINGERFIELD	CYPRESS	MORRIS	O' THE PINES LAKE/RESERVOIR	10332	10332	10332	10332	10332	10332	
HUGHES SPRINGS	CYPRESS	MORRIS	O' THE PINES LAKE/RESERVOIR	28	28	28	28	28	28	
LONE STAR	CYPRESS	MORRIS	O' THE PINES LAKE/RESERVOIR	4841	4841	4841	4841	4841	4841	
NAPLES	CYPRESS	MORRIS	CARRIZO-WILCOX AQUIFER	101	101	101	101	101	101	
OMAHA	CYPRESS	MORRIS	CARRIZO-WILCOX AQUIFER	119	119	119	119	119	119	
COUNTY-OTHER	CYPRESS	MORRIS	O' THE PINES LAKE/RESERVOIR	1309	1306	1303	1300	1300	1300	
COUNTY-OTHER	CYPRESS	MORRIS	CARRIZO-WILCOX AQUIFER	233	233	233	233	233	233	
MANUFACTURING	CYPRESS	MORRIS	O' THE PINES LAKE/RESERVOIR	32400	32400	32400	32400	32400	32400	
MANUFACTURING	CYPRESS	MORRIS	ELLISON CREEK LAKE/RESERVOIR	13037	13037	13037	13037	13037	13037	
MANUFACTURING	CYPRESS	MORRIS	QUEEN CITY AQUIFER	4383	4383	4383	4383	4383	4383	
MANUFACTURING	CYPRESS	MORRIS	INDIRECT REUSE	77481	72086	66660	61344	62600	71474	
STEAM ELECTRIC POWER	CYPRESS	MORRIS	ELLISON CREEK LAKE/RESERVOIR	820	820	820	820	820	820	
MINING	CYPRESS	MORRIS	QUEEN CITY AQUIFER	35	34	34	34	34	34	
LIVESTOCK	CYPRESS	MORRIS	LIVESTOCK LOCAL SUPPLY	215	215	215	215	215	215	
LIVESTOCK	CYPRESS	MORRIS	QUEEN CITY AQUIFER	115	115	115	115	115	115	
BI-COUNTY WSC	CYPRESS	MORRIS	CARRIZO-WILCOX AQUIFER	149	149	149	149	149	149	
TRI WSC	CYPRESS	MORRIS	CARRIZO-WILCOX AQUIFER	123	123	123	123	123	123	
NAPLES	SULPHUR	MORRIS	CARRIZO-WILCOX AQUIFER	109	109	109	109	109	109	
COUNTY-OTHER	SULPHUR	MORRIS	CARRIZO-WILCOX AQUIFER	307	307	307	307	307	307	
LIVESTOCK	SULPHUR	MORRIS	CARRIZO-WILCOX AQUIFER	155	155	155	155	155	155	
OMAHA	SULPHUR	MORRIS	CARRIZO-WILCOX AQUIFER	90	90	90	90	90	90	
RAINS COUNTY										
EAST TAWAKONI	SABINE	RAINS	TAWAKONI LAKE/RESERVOIR	552	552	552	552	552	552	EMORY CITY OF
EMORY	SABINE	RAINS	TAWAKONI LAKE/RESERVOIR	845	831	817	803	789	776	SABINE RIVER AUTHORIT
POINT	SABINE	RAINS	TAWAKONI LAKE/RESERVOIR	261	258	255	252	249	246	SABINE RIVER AUTHORIT
COUNTY-OTHER	SABINE	RAINS	TAWAKONI LAKE/RESERVOIR	318	318	318	318	318	318	
COUNTY-OTHER	SABINE	RAINS	NACATOCH AQUIFER	58	69	75	77	76	74	

Water User Group Name	Basin	County	Source Name	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060	SELLERS_NAME
COUNTY-OTHER	SABINE	RAINS	CARRIZO-WILCOX AQUIFER	77	77	77	77	77	77	
COUNTY-OTHER	SABINE	RAINS	CARRIZO-WILCOX AQUIFER	181	204	217	220	218	215	
COUNTY-OTHER	SABINE	RAINS	CARRIZO-WILCOX AQUIFER	6	7	7	7	7	7	
MANUFACTURING	SABINE	RAINS	TAWAKONI LAKE/RESERVOIR	2	2	2	2	2	2	
LIVESTOCK	SABINE	RAINS	LIVESTOCK LOCAL SUPPLY	675	675	675	675	675	675	
BRIGHT STAR-SALEM WSC	SABINE	RAINS	CARRIZO-WILCOX AQUIFER	298	298	298	298	298	298	
BRIGHT STAR-SALEM WSC	SABINE	RAINS	CARRIZO-WILCOX AQUIFER	187	187	187	187	187	187	
CASH SUD	SABINE	RAINS	TAWAKONI LAKE/RESERVOIR	86	103	115	118	117	115	SABINE RIVER AUTHORIT
RED RIVER COUNTY										
COUNTY-OTHER	RED	RED RIVER	PAT MAYSE LAKE/RESERVOIR	118	118	118	118	118	118	
COUNTY-OTHER	RED	RED RIVER	WRIGHT PATMAN LAKE/RESERVOIR	72	72	72	72	72	72	
COUNTY-OTHER	RED	RED RIVER	TRINITY AQUIFER	23	23	23	23	23	23	
IRRIGATION	RED	RED RIVER	IRRIGATION LOCAL SUPPLY	2024	2003	1982	1961	1941	1921	
LIVESTOCK	RED	RED RIVER	LIVESTOCK LOCAL SUPPLY	396	396	396	396	396	396	
LIVESTOCK	RED	RED RIVER	BLOSSOM AQUIFER	94	94	94	94	94	94	
LIVESTOCK	RED	RED RIVER	WOODBINE AQUIFER	170	170	170	170	170	170	
RED RIVER COUNTY WSC	RED	RED RIVER	PAT MAYSE LAKE/RESERVOIR	184	184	184	184	184	184	LAMAR COUNTY WSD
RED RIVER COUNTY WSC	RED	RED RIVER	WRIGHT PATMAN LAKE/RESERVOIR	22	21	21	21	21	21	TEXARKANA CITY OF
RED RIVER COUNTY WSC	RED	RED RIVER	BLOSSOM AQUIFER	30	30	30	30	30	30	
BOGATA	SULPHUR	RED RIVER	NACATOCH AQUIFER	358	358	358	358	358	358	
CLARKSVILLE	SULPHUR	RED RIVER	LANGFORD LAKE/RESERVOIR	377	377	377	377	377	377	
CLARKSVILLE	SULPHUR	RED RIVER	BLOSSOM AQUIFER	360	360	360	360	360	360	
DETROIT	SULPHUR	RED RIVER	PAT MAYSE LAKE/RESERVOIR	41	41	41	41	41	41	LAMAR COUNTY WSD
DETROIT	SULPHUR	RED RIVER	TRINITY AQUIFER	59	59	59	59	59	59	
COUNTY-OTHER	SULPHUR	RED RIVER	PAT MAYSE LAKE/RESERVOIR	138	135	132	129	129	129	
COUNTY-OTHER	SULPHUR	RED RIVER	WRIGHT PATMAN LAKE/RESERVOIR	112	112	112	112	112	112	
COUNTY-OTHER	SULPHUR	RED RIVER	NACATOCH AQUIFER	45	44	43	42	42	42	
COUNTY-OTHER	SULPHUR	RED RIVER	NACATOCH AQUIFER	12	12	12	12	12	12	
MANUFACTURING	SULPHUR	RED RIVER	LANGFORD LAKE/RESERVOIR	6	7	7	7	7	8	
STEAM ELECTRIC POWER	SULPHUR	RED RIVER	SULPHUR RIVER COMBINED RUN-OF-RIVER	534	425	497	585	692	823	
STEAM ELECTRIC POWER	SULPHUR	RED RIVER	RIVER CREST LAKE/RESERVOIR	80	64	75	88	104	123	
IRRIGATION	SULPHUR	RED RIVER	IRRIGATION LOCAL SUPPLY	1689	1672	1655	1638	1621	1603	
LIVESTOCK	SULPHUR	RED RIVER	LIVESTOCK LOCAL SUPPLY	911	911	911	911	911	911	
LIVESTOCK	SULPHUR	RED RIVER	NACATOCH AQUIFER	38	38	38	38	38	38	
DEPORT	SULPHUR	RED RIVER	PAT MAYSE LAKE/RESERVOIR	7	7	7	7	7	7	LAMAR COUNTY WSD
RED RIVER COUNTY WSC	SULPHUR	RED RIVER	PAT MAYSE LAKE/RESERVOIR	0	0	0	0	0	0	LAMAR COUNTY WSD
RED RIVER COUNTY WSC	SULPHUR	RED RIVER	WRIGHT PATMAN LAKE/RESERVOIR	41	41	41	41	41	41	TEXARKANA CITY OF
RED RIVER COUNTY WSC	SULPHUR	RED RIVER	BLOSSOM AQUIFER	223	223	223	223	223	223	
RED RIVER COUNTY WSC	SULPHUR	RED RIVER	NACATOCH AQUIFER	204	204	204	204	204	204	
SMITH COUNTY										

Water User Group Name	Basin	County	Source Name	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060	SELLERS_NAME
LINDALE	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	1126	1126	1126	1126	1126	1126	
OVERTON	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	18	19	20	22	22	23	
TYLER	SABINE	SMITH	TYLER LAKE/RESERVOIR	1000	1000	1000	1000	1000	1000	
TYLER	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	117	117	117	117	117	117	
COUNTY-OTHER	SABINE	SMITH	GLADEWATER LAKE/RESERVOIR	23	23	23	23	23	23	
COUNTY-OTHER	SABINE	SMITH	TYLER LAKE/RESERVOIR	28	34	43	51	62	74	
COUNTY-OTHER	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	2932	3145	3361	3586	3953	4415	
MANUFACTURING	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	225	252	275	298	317	343	
MINING	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	24	48	88	109	151	187	
MINING	SABINE	SMITH	QUEEN CITY AQUIFER	274	272	272	272	272	272	
IRRIGATION	SABINE	SMITH	IRRIGATION LOCAL SUPPLY	382	400	421	442	464	488	
LIVESTOCK	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	216	216	216	216	216	216	
LIVESTOCK	SABINE	SMITH	QUEEN CITY AQUIFER	242	242	242	242	242	242	
WINONA	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	118	124	133	141	152	164	
CRYSTAL SYSTEMS INC	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	960	960	960	960	960	960	
JACKSON WSC	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	38	43	48	53	62	74	
LIBERTY CITY WSC	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	10	10	10	10	10	10	
LINDALE RURAL WSC	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	528	528	528	528	528	528	
SMITH COUNTY WCID #1	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	887	887	887	887	887	887	
SOUTHERN UTILITIES COMPANY	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	1800	1900	2100	2300	2700	3200	
WEST GREGG WSC	SABINE	SMITH	CARRIZO-WILCOX AQUIFER	109	109	109	109	109	109	
TITUS COUNTY										
MOUNT PLEASANT	CYPRESS	TITUS	BOB SANDLIN LAKE/RESERVOIR	4708	4451	4209	4022	3798	3402	TITUS COUNTY FWD #1
MOUNT PLEASANT	CYPRESS	TITUS	CYPRESS SPRINGS LAKE/RESERVOIR	2443	2203	1963	1723	1483	1233	
MOUNT PLEASANT	CYPRESS	TITUS	TANKERSLEY LAKE/RESERVOIR	1164	1107	1064	1021	1956	801	
COUNTY-OTHER	CYPRESS	TITUS	BOB SANDLIN LAKE/RESERVOIR	159	159	159	159	159	159	
COUNTY-OTHER	CYPRESS	TITUS	CARRIZO-WILCOX AQUIFER	393	415	438	457	475	490	
MANUFACTURING	CYPRESS	TITUS	BOB SANDLIN LAKE/RESERVOIR	2711	2795	2859	2922	2933	3067	
MANUFACTURING	CYPRESS	TITUS	TANKERSLEY LAKE/RESERVOIR	2796	2883	2948	3014	3199	3531	
MANUFACTURING	CYPRESS	TITUS	CARRIZO-WILCOX AQUIFER	1709	1887	2027	2150	2163	2263	
STEAM ELECTRIC POWER	CYPRESS	TITUS	O' THE PINES LAKE/RESERVOIR	12000	12000	12000	12000	12000	12000	
STEAM ELECTRIC POWER	CYPRESS	TITUS	WELSH LAKE/RESERVOIR	3739	3739	3739	3739	3739	3739	
STEAM ELECTRIC POWER	CYPRESS	TITUS	BOB SANDLIN LAKE/RESERVOIR	38500	38500	38500	38500	38500	38500	
STEAM ELECTRIC POWER	CYPRESS	TITUS	MONTICELLO LAKE/RESERVOIR	6098	6098	6098	6098	6098	6098	
MINING	CYPRESS	TITUS	BOB SANDLIN LAKE/RESERVOIR	1384	860	690	647	689	834	
MINING	CYPRESS	TITUS	CARRIZO-WILCOX AQUIFER	1790	2714	3109	3376	3559	3653	
LIVESTOCK	CYPRESS	TITUS	CARRIZO-WILCOX AQUIFER	433	433	433	433	433	433	
BI-COUNTY WSC	CYPRESS	TITUS	CARRIZO-WILCOX AQUIFER	151	151	151	151	151	151	
CYPRESS SPRINGS WSC	CYPRESS	TITUS	CYPRESS SPRINGS LAKE/RESERVOIR	48	48	48	48	48	48	FRANKLIN COUNTY WD
TRI WSC	CYPRESS	TITUS	BOB SANDLIN LAKE/RESERVOIR	763	849	944	1009	1068	1119	MOUNT PLEASANT CITY O
TALCO	SULPHUR	TITUS	NACATOCH AQUIFER	453	453	453	453	453	453	
COUNTY-OTHER	SULPHUR	TITUS	BOB SANDLIN LAKE/RESERVOIR	547	600	656	689	723	761	
COUNTY-OTHER	SULPHUR	TITUS	NACATOCH AQUIFER	437	472	509	531	553	576	

Water User Group Name	Basin	County	Source Name	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060	SELLERS_NAME
MINING	SULPHUR	TITUS	CARRIZO-WILCOX AQUIFER	320	361	383	406	429	453	
LIVESTOCK	SULPHUR	TITUS	LIVESTOCK LOCAL SUPPLY	156	156	156	156	156	156	
LIVESTOCK	SULPHUR	TITUS	CARRIZO-WILCOX AQUIFER	418	418	418	418	418	418	
UPSHUR COUNTY										
GILMER	CYPRESS	UPSHUR	GILMER LAKE/RESERVOIR	5430	5430	5430	5430	5430	5430	
GILMER	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	1102	1102	1102	1102	1102	1102	
ORE CITY	CYPRESS	UPSHUR	O' THE PINES LAKE/RESERVOIR	2682	2682	2682	2682	2682	2682	
ORE CITY	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	218	218	218	218	218	218	
COUNTY-OTHER	CYPRESS	UPSHUR	O' THE PINES LAKE/RESERVOIR	381	381	381	381	381	381	NORTHEAST TEXAS MWD
COUNTY-OTHER	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	1232	1295	1335	1357	1375	1400	
MANUFACTURING	CYPRESS	UPSHUR	GILMER LAKE/RESERVOIR	200	200	200	200	200	200	
MANUFACTURING	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	48	72	91	112	130	155	
MINING	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	1	1	1	1	1	1	
LIVESTOCK	CYPRESS	UPSHUR	LIVESTOCK LOCAL SUPPLY	975	975	975	975	975	975	
LIVESTOCK	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	218	218	218	218	218	218	
EAST MOUNTAIN	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	48	48	48	48	48	48	
BI-COUNTY WSC	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	445	445	445	445	445	445	
DIANA WSC	CYPRESS	UPSHUR	O' THE PINES LAKE/RESERVOIR	658	658	658	658	658	658	NORTHEAST TEXAS MWD
DIANA WSC	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	605	605	605	605	605	605	
PRITCHETT WSC	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	296	296	296	296	296	296	
SHARON WSC	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	323	323	323	323	323	323	
IRRIGATION	CYPRESS	UPSHUR	CARRIZO-WILCOX AQUIFER	240	240	240	240	240	240	
BIG SANDY	SABINE	UPSHUR	CARRIZO-WILCOX AQUIFER	328	328	328	328	328	328	
EAST MOUNTAIN	SABINE	UPSHUR	CARRIZO-WILCOX AQUIFER	280	280	280	280	280	280	
GLADEWATER	SABINE	UPSHUR	GLADEWATER LAKE/RESERVOIR	607	607	607	607	607	607	
COUNTY-OTHER	SABINE	UPSHUR	BIG SANDY CREEK LAKE/RESERVOIR	190	190	190	190	190	190	LONGVIEW CITY OF
COUNTY-OTHER	SABINE	UPSHUR	GLADEWATER LAKE/RESERVOIR	112	112	112	112	112	112	
COUNTY-OTHER	SABINE	UPSHUR	CARRIZO-WILCOX AQUIFER	472	472	472	472	472	472	
LIVESTOCK	SABINE	UPSHUR	LIVESTOCK LOCAL SUPPLY	293	293	293	293	293	293	
LIVESTOCK	SABINE	UPSHUR	CARRIZO-WILCOX AQUIFER	44	44	44	44	44	44	
PRITCHETT WSC	SABINE	UPSHUR	CARRIZO-WILCOX AQUIFER	551	551	551	551	551	551	
VAN ZANDT COUNTY										
VAN	NECHES	VAN ZANDT	CARRIZO-WILCOX AQUIFER	652	649	637	628	616	602	
COUNTY-OTHER	NECHES	VAN ZANDT	CARRIZO-WILCOX AQUIFER	1713	1834	1937	2014	2111	2220	
MINING	NECHES	VAN ZANDT	CARRIZO-WILCOX AQUIFER	110	126	137	147	158	168	
IRRIGATION	NECHES	VAN ZANDT	CARRIZO-WILCOX AQUIFER	33	33	33	33	33	33	
LIVESTOCK	NECHES	VAN ZANDT	LIVESTOCK LOCAL SUPPLY	613	613	613	613	613	613	
LIVESTOCK	NECHES	VAN ZANDT	CARRIZO-WILCOX AQUIFER	59	59	59	59	59	59	
BETHEL-ASH WSC	NECHES	VAN ZANDT	CARRIZO-WILCOX AQUIFER	57	54	51	48	45	42	
R P M WSC	NECHES	VAN ZANDT	CARRIZO-WILCOX AQUIFER	237	237	237	237	237	237	
CANTON	SABINE	VAN ZANDT	MILL CREEK LAKE/RESERVOIR	706	706	706	706	706	706	
CANTON	SABINE	VAN ZANDT	CARRIZO-WILCOX AQUIFER	97	97	97	97	97	97	
EDGEWOOD	SABINE	VAN ZANDT	EDGEWOOD CITY LAKE/RESERVOIR	110	110	110	110	110	110	

Water User Group Name	Basin	County	Source Name	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060	SELLERS_NAME
EDGEWOOD	SABINE	VAN ZANDT	TAWAKONI LAKE/RESERVOIR	793	787	781	776	770	764	SABINE RIVER AUTHORIT
GRAND SALINE	SABINE	VAN ZANDT	CARRIZO-WILCOX AQUIFER	562	562	562	562	562	562	
VAN	SABINE	VAN ZANDT	CARRIZO-WILCOX AQUIFER	131	134	146	155	167	181	
WILLS POINT	SABINE	VAN ZANDT	TAWAKONI LAKE/RESERVOIR	648	648	648	648	648	648	SABINE RIVER AUTHORIT
COUNTY-OTHER	SABINE	VAN ZANDT	CARRIZO-WILCOX AQUIFER	1662	1724	1775	1813	1862	1916	
MANUFACTURING	SABINE	VAN ZANDT	TAWAKONI LAKE/RESERVOIR	262	293	319	343	363	401	
MANUFACTURING	SABINE	VAN ZANDT	CARRIZO-WILCOX AQUIFER	116	116	116	116	116	116	
MINING	SABINE	VAN ZANDT	OTHER LOCAL SUPPLY	589	847	1007	1170	1337	1498	
MINING	SABINE	VAN ZANDT	CARRIZO-WILCOX AQUIFER	1100	1100	1100	1100	1100	1100	
LIVESTOCK	SABINE	VAN ZANDT	LIVESTOCK LOCAL SUPPLY	1035	1035	1035	1035	1035	1035	
LIVESTOCK	SABINE	VAN ZANDT	CARRIZO-WILCOX AQUIFER	89	89	89	89	89	89	
ABLE SPRINGS WSC	SABINE	VAN ZANDT	TAWAKONI LAKE/RESERVOIR	9	9	9	9	9	9	SABINE RIVER AUTHORIT
COMBINED CONSUMERS WSC	SABINE	VAN ZANDT	TAWAKONI LAKE/RESERVOIR	229	266	297	321	351	384	SABINE RIVER AUTHORIT
MAC BEE WSC	SABINE	VAN ZANDT	TAWAKONI LAKE/RESERVOIR	822	822	822	819	753	650	SABINE RIVER AUTHORIT
MAC BEE WSC	SABINE	VAN ZANDT	CARRIZO-WILCOX AQUIFER	108	108	108	108	108	108	
SOUTH TAWAKONI WSC	SABINE	VAN ZANDT	TAWAKONI LAKE/RESERVOIR	1056	1048	1041	1033	1025	1018	SABINE RIVER AUTHORIT
WILLS POINT	TRINITY	VAN ZANDT	TAWAKONI LAKE/RESERVOIR	1458	1443	1427	1412	1396	1381	SABINE RIVER AUTHORIT
COUNTY-OTHER	TRINITY	VAN ZANDT	CARRIZO-WILCOX AQUIFER	160	160	160	160	160	160	
COUNTY-OTHER	TRINITY	VAN ZANDT	CARRIZO-WILCOX AQUIFER	405	466	517	555	604	658	
MINING	TRINITY	VAN ZANDT	CARRIZO-WILCOX AQUIFER	63	73	79	85	91	97	
LIVESTOCK	TRINITY	VAN ZANDT	LIVESTOCK LOCAL SUPPLY	611	599	527	449	340	282	
LIVESTOCK	TRINITY	VAN ZANDT	CARRIZO-WILCOX AQUIFER	26	38	110	188	297	355	
MAC BEE WSC	TRINITY	VAN ZANDT	TAWAKONI LAKE/RESERVOIR	1152	1136	1120	1104	1088	1072	SABINE RIVER AUTHORIT
WOOD COUNTY										
WINNSBORO	CYPRESS	WOOD	CYPRESS SPRINGS LAKE/RESERVOIR	300	300	300	300	300	300	
COUNTY-OTHER	CYPRESS	WOOD	CARRIZO-WILCOX AQUIFER	26	29	31	31	31	31	
IRRIGATION	CYPRESS	WOOD	CARRIZO-WILCOX AQUIFER	125	125	125	125	125	125	
LIVESTOCK	CYPRESS	WOOD	LIVESTOCK LOCAL SUPPLY	165	165	165	165	165	165	
CYPRESS SPRINGS WSC	CYPRESS	WOOD	CYPRESS SPRINGS LAKE/RESERVOIR	76	76	76	76	76	76	FRANKLIN COUNTY WD
SHARON WSC	CYPRESS	WOOD	CARRIZO-WILCOX AQUIFER	139	139	139	139	139	139	
HAWKINS	SABINE	WOOD	CARRIZO-WILCOX AQUIFER	1453	1453	1453	1453	1453	1453	
MINEOLA	SABINE	WOOD	CARRIZO-WILCOX AQUIFER	869	869	869	869	869	869	
QUITMAN	SABINE	WOOD	FORK LAKE/RESERVOIR	1026	1019	1012	1004	997	990	SABINE RIVER AUTHORIT
WINNSBORO	SABINE	WOOD	CYPRESS SPRINGS LAKE/RESERVOIR	500	500	500	500	500	500	
COUNTY-OTHER	SABINE	WOOD	CARRIZO-WILCOX AQUIFER	2	2	2	2	2	2	
COUNTY-OTHER	SABINE	WOOD	CARRIZO-WILCOX AQUIFER	4499	4579	4623	4626	4625	4625	
MANUFACTURING	SABINE	WOOD	CARRIZO-WILCOX AQUIFER	118	126	133	139	144	155	
MINING	SABINE	WOOD	QUEEN CITY AQUIFER	302	309	313	317	321	324	
IRRIGATION	SABINE	WOOD	CARRIZO-WILCOX AQUIFER	22	22	22	22	22	22	
IRRIGATION	SABINE	WOOD	QUEEN CITY AQUIFER	226	226	226	226	226	226	
LIVESTOCK	SABINE	WOOD	LIVESTOCK LOCAL SUPPLY	1897	1897	1897	1897	1897	1897	
BRIGHT STAR-SALEM WSC	SABINE	WOOD	CARRIZO-WILCOX AQUIFER	212	212	212	212	212	212	

Water User Group Name	Basin	County	Source Name	WS2010	WS2020	WS2030	WS2040	WS2050	WS2060	SELLERS_NAME
PRITCHETT WSC	SABINE	WOOD	CARRIZO-WILCOX AQUIFER	3	3	3	3	3	3	
RAMEY WSC	SABINE	WOOD	CARRIZO-WILCOX AQUIFER	602	602	602	602	602	602	
SHARON WSC	SABINE	WOOD	CARRIZO-WILCOX AQUIFER	434	434	434	434	434	434	

CHAPTER 4 APPENDIX

REGION D - NORTH EAST TEXAS
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

1) Table of Contents: Strategy Recommendations Summary to 2060

2) Evaluations of Water Management Strategies by County

Region D - North East Texas
STRATEGY RECOMMENDATION SUMMARY to 2060

County	WUG/ CO	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) By Year						Strategy	Supply Source				Reliability of Source
			2010	2020	2030	2040	2050	2060		Ground Water	Surface Water	County	Basin	
Bowie	WUG	Central Bowie WSC	-257 257	-303 303	-336 336	-369 369	-362 362	-353 353	Contract		Lake Wright Patman	Bowie	Sulphur	High
Bowie	WUG	Hooks, City of	-81 81	-108 108	-130 130	-151 151	-151 151	-151 151	Contract		Lake Wright Patman	Bowie	Sulphur	High
Bowie	WUG	Macedonia-Eylau MUD	-217 217	-251 251	-270 270	-294 294	-279 279	-270 270	Contract		Lake Wright Patman	Bowie	Sulphur	High
Bowie	WUG	New Boston, City of	-45 45	-101 101	-139 139	-175 175	-168 168	-168 168	Contract		Lake Wright Patman	Bowie	Sulphur	High
Bowie	WUG	Redwater, City of		-4 4	-7 7	-14 14	-14 14	-14 14	Contract		Lake Wright Patman	Bowie	Sulphur	High
Bowie	WUG	Wake Village	-356 356	-414 414	-472 472	-529 529	-587 587	-645 645	Contract		Lake Wright Patman	Bowie	Sulphur	High
Bowie	CO	Burns-Redbank WSC	-91 91	-100 100	-106 106	-110 110	-106 106	-103 103	Contract		Lake Wright Patman	Bowie	Sulphur	High
Bowie	CO	Oak Grove WSC	-31 31	-35 35	-37 37	-39 39	-37 37	-36 36	Contract		Lake Wright Patman	Bowie	Sulphur	High
Bowie	CO	Red River Redevelopment Authority	-1343 1343	-1890 1890	-2435 2435	-2981 2981	-3527 3527	-4074 4074	Contract		Caney Creek Lake / Elliott Creek Lake	Bowie	Sulphur	High
Bowie	CO	Redwater, City of	-146 146	-155 155	-160 160	-164 164	-160 160	-157 157	Contract		Lake Wright Patman	Bowie	Sulphur	High
Camp	WUG	Bi-County WSC		-128 134	-299 134 519	-434 134 519	-539 134 519	-653 134 519	Contract		NETMWD, Lake Bob Sandlin	Titus	Cypress	High
Camp	CO	Woodland Harbor	-61 65	-60 65	-60 65	-60 65	-60 65	-60 65	2 wells	Carrizo-Wilcox		Camp	Cypress	High
Cass	WUG	Linden, City of	-92 215	-98 215	-101 215	-106 215	-104 215	-104 215	1 well	Carrizo-Wilcox		Cass	Cypress	High
Cass	CO	*None*												
Delta	WUG	*None*												
Delta	CO	Ben Franklin WSC			-33 36	-36 36	-36 36	-36 36	Contract		Big Creek Lake	Delta	Sulphur	High
Franklin	WUG	*None*												
Franklin	CO	*None*												
Gregg	WUG	Clarksville City, City of	-120 162	-134 162	-148 162	-164 242	-186 242	-217 242	3 wells	Carrizo-Wilcox		Gregg	Sabine	High
Gregg	WUG	Liberty City WSC	-133 188	-209 282	-287 376	-378 470	-502 564	-678 752	8 wells	Carrizo-Wilcox		Gregg	Sabine	High

Region D - North East Texas
STRATEGY RECOMMENDATION SUMMARY to 2060

County	WUG/ CO	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) By Year 2010	2020	2030	2040	2050	2060	Strategy	Supply Source Ground Water	Surface Water	County	Basin	Reliability of Source
Gregg	WUG	West Gregg SUD			-56 70	-119 140	-208 210	-333 350	5 wells	Carrizo-Wilcox		Gregg	Sabine	High
Gregg	CO	Liberty-Danville FWSD No. 2				-1 1	-17 17	-40 40	Contract		Sabine Run of the River	Gregg	Sabine	High
Gregg	CO	Starrville-Friendship WSC				-19 108	-54 108	-101 108	1 well	Carrizo-Wilcox		Smith	Sabine	High
Harrison	WUG	Waskom, City of		-21 44	-54 88	-79 88	-108 132	-151 176	4 wells	Carrizo-Wilcox		Harrison	Cypress	High
Harrison	WUG	Steam Electric				-1852 1852	-6887 6887	-12914 12914	Contract		Lake O' The Pines	Marion	Cypress	High
Harrison	CO	Blocker-Crossroads WSC	-78 86	-91 86	-100 129	-107 129	-116 129	-128 129	3 wells	Carrizo-Wilcox		Harrison	Sabine	High
Harrison	CO	Caddo Lake WSC	-10 43	-6 43	-19 43	-27 43	-37 43	-52 86	2 wells	Carrizo-Wilcox		Harrison	Cypress	High
Harrison	CO	Harleton WSC	-91 91	-130 130	-158 158	-179 179	-204 204	-240 240	Contract		Lake O' The Pines	Marion	Cypress	High
Harrison	CO	Leigh WSC					-7 43	-36 43	1 well	Carrizo-Wilcox		Harrison	Cypress	High
Harrison	CO	Scottsville, City of						-7 65	1 well	Carrizo-Wilcox		Harrison	Cypress	High
Harrison	CO	Talley WSC	-59 59	-81 118	-97 118	-109 118	-122 177	-142 177	3 wells	Carrizo-Wilcox		Harrison	Sabine	High
Hopkins	WUG	*None*												
Hopkins	CO	Miller Grove WSC			-24 35	-30 35	-17 35	-6 35	1 well	Nacatoch		Hopkins	Sulphur	High
Hunt	WUG	Able Springs WSC					-47 47	-143 143	Contract		SRA, Toledo Bend Transfer	-	-	High
Hunt	WUG	Campbell WSC	-9 108	-46 108	-101 108	-201 108 93	-424 108 316	-773 108 665	2 wells / Contract	Nacatoch	City of Commerce, Lake Tawakoni	Hunt	Sabine	High High
Hunt	WUG	Cash SUD	537	821	961	1059	1126	-4305 3121 1184	Contract Contract		SRA, Toledo Bend Transfer NTMWD, Future Allocation	- -	- -	High
Hunt	WUG	Celeste, City of					-34 34	-101 101	Contract		City of Greenville, Lake Tawakoni	Hunt	Sabine	High
Hunt	WUG	Combined Consumers WSC			-75 75	-621 621	-1801 1801	-3631 3631	Contract		SRA, Toledo Bend Transfer	-	-	High
Hunt	WUG	Hickory Creek SUD	-70 269	-154 269	-271 483	-474 483	-931 966	-1666 1771	7 Wells	Woodbine		Hunt	-	High
Hunt	WUG	North Hunt WSC		-70 70	-179 179	-363 363	-780 780	-1444 1444	Contract		City of Commerce, Lake Tawakoni	Hunt	Sabine	High
Hunt	WUG	Steam Electric	-8639 8639	-12366 12366	-14457 14457	-17006 17006	-20114 20114	-23902 23902	Contract		SRA, Toledo Bend Transfer	-	-	High

Region D - North East Texas
STRATEGY RECOMMENDATION SUMMARY to 2060

County	WUG/ CO	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) By Year 2010	2020	2030	2040	2050	2060	Strategy	Supply Source: Ground Water	Surface Water	County	Basin	Reliability of Source
Hunt	WUG	Wolfe City	-66 81	-72 81	-101 162	-115 162	-147 162	-195 202	Contract		City of Commerce, Lake Tawakoni	Hunt	Sabine	High
Hunt	CO	Jacobia WSC					-84 84	-328 328	Contract		City of Greenville, Lake Tawakoni	Hunt	Sabine	High
Hunt	CO	Little Creek Acres	-20 43	-27 43	-37 43	-54 108	-93 108	-153 172	Contract		Cash WSC, Lake Tawakoni	Hunt	Sabine	High
Hunt	CO	Maloy WSC	-26 26	-39 39	-57 57	-84 84	-154 154	-263 263	Contract		City of Commerce, Lake Tawakoni	Hunt	Sabine	High
Hunt	CO	Poetry WSC				-1 1	-14 14	-46 46	Contract		City of Terrell, Lake Tawakoni	Hunt	Sabine	High
Hunt	CO	Shady Grove WSC						-280 280	Contract		City of Greenville, Lake Tawakoni	Hunt	Sabine	High
Hunt	CO	West Leonard WSC	-2 32	-3 32	-5 32	-9 32	-16 32	-28 32	1 well	Woodbine		Fannin	Trinity	High
Lamar	WUG	Steam Electric			-980 980	-2733 2733	-4870 4870	-7474 7474	Contract		City of Paris, Pat Mayse Lake	Lamar	Red River	High
Lamar	CO	Petty WSC	-1 20	-2 20	-20 20	-21 20	-20 20	-20 20	Contract		LCWSD, Pat Mayse Lake	Lamar	Red River	High
Marion	WUG	*None*												
Marion	CO	*None*												
Morris	WUG	*None*												
Morris	CO	*None*												
Rains	WUG	*None*												
Rains	CO	South Rains WSC	-160 160	-239 239	-284 284	-295 295	-287 287	-277 277	Contract		City of Emory, Lake Tawakoni	Hunt	Sabine	High
Red River	WUG	*None*												
Red River	CO	*None*												
Smith	WUG	Crystal Systems Inc.				-45 269	-209 269	-425 538	2 wells	Carrizo-Wilcox		Smith	Sabine	High
Smith	WUG	Lindale Rural WSC					-77 215	-189 215	1 well	Carrizo-Wilcox		Smith	Sabine	High
Smith	WUG	Lindale, City of					-101 376	-374 376	1 well	Carrizo-Wilcox		Smith	Sabine	High
Smith	WUG	Winona, City of						-5 5	Contract	Carrizo-Wilcox		Smith	Sabine	High

Region D - North East Texas
STRATEGY RECOMMENDATION SUMMARY to 2060

County	WUG/ CO	Entity	Projected Deficit (-) / Recommendation (ac-ft/yr) By Year						Strategy	Supply Source				Reliability of Source
			2010	2020	2030	2040	2050	2060		Ground Water	Surface Water	County	Basin	
Smith	CO	Star Mountain WSC				-1 108	-36 108	-83 108	1 well	Carrizo-Wilcox		Smith	Sabine	High
Titus	WUG	Steam Electric			-951 951	-11759 11759	-24933 24933	-40992 40992	Contract		NETMWD, Lake O' the Pines	Cass	Cypress	High
Titus	CO	*None*												
Upshur	WUG	Pritchett WSC				-7 54	-25 54	-51 54	1 well	Carrizo-Wilcox		Upshur	Sabine	High
Van Zandt	WUG	Bethel Ash WSC				-2 27	-9 27	-17 27	1 well	Carrizo-Wilcox		Van Zandt	Neches	High
Van Zandt	WUG	Canton, City of	-120 194	-175 194	-217 291	-245 291	-292 387	-349 387	4 wells	Carrizo-Wilcox		Van Zandt	Sabine	High
Van Zandt	WUG	Grand Saline, City of	-65 161	-109 161	-143 161	-169 322	-207 322	-255 322	2 wells	Carrizo-Wilcox		Van Zandt	Sabine	High
Van Zandt	WUG	R-P-M WSC		-8 37	-30 37	-46 102	-70 102	-99 102	2 wells	Carrizo-Wilcox		Van Zandt	Neches	High
Van Zandt	CO	Corinth WSC					-6 27	-23 27	1 well	Carrizo-Wilcox		Van Zandt	Sabine	High
Van Zandt	CO	Crooked Creek WSC		-8 59	-21 59	-30 59	-42 59	-56 59	1 well	Carrizo-Wilcox		Van Zandt	Sabine	High
Van Zandt	CO	Edom WSC		-16 16	-34 34	-48 48	-66 66	-86 86	2 wells	Carrizo-Wilcox		Van Zandt	Sabine	High
Van Zandt	CO	Fruitvale WSC		-64 108	-119 161	-159 161	-211 269	-269 269	7 wells	Carrizo-Wilcox		Van Zandt	Sabine	High
Van Zandt	CO	Little Hope-Moore WSC	-13 161	-48 161	-78 161	-101 161	-129 161	-161 161	5 wells	Carrizo-Wilcox		Van Zandt	Sabine / Neches	High
Wood	WUG	Mineola, City of	-203 403	-318 403	-374 403	-367 403	-360 403	-360 403	1 well	Carrizo-Wilcox		Wood	Sabine	High
Wood	CO	Yantis, City of	-8 38	-16 38	-20 38	-19 38	-18 38	-18 38	1 well	Carrizo-Wilcox		Wood	Sabine	High

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

BOWIE COUNTY

WUGs:

Red River Redevelopment Authority

County Other:

None

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CENTRAL BOWIE WATER SUPPLY CORPORATION IN BOWIE COUNTY

Description of Water User Group:

Central Bowie WSC provides water service in Bowie County. The WUG population is projected to be 5,425 in 2010 and 6,169 in the year 2060. The WSC has a contract for water supply with the City of Texarkana for 442 ac-ft/yr. The WSC is projected to have a deficit of 257 ac-ft in 2010 and increasing to a deficit of 353 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	5425	5779	6040	6300	6235	6169
Projected Water Demand	699	745	778	811	804	795
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	442	442	442	442	442	442
Projected Supply Surplus (+) / Deficit (-)	**-257**	**-303**	**-336**	**-369**	**-362**	**-353**

Evaluation of Potentially Feasible Water Management Strategies:

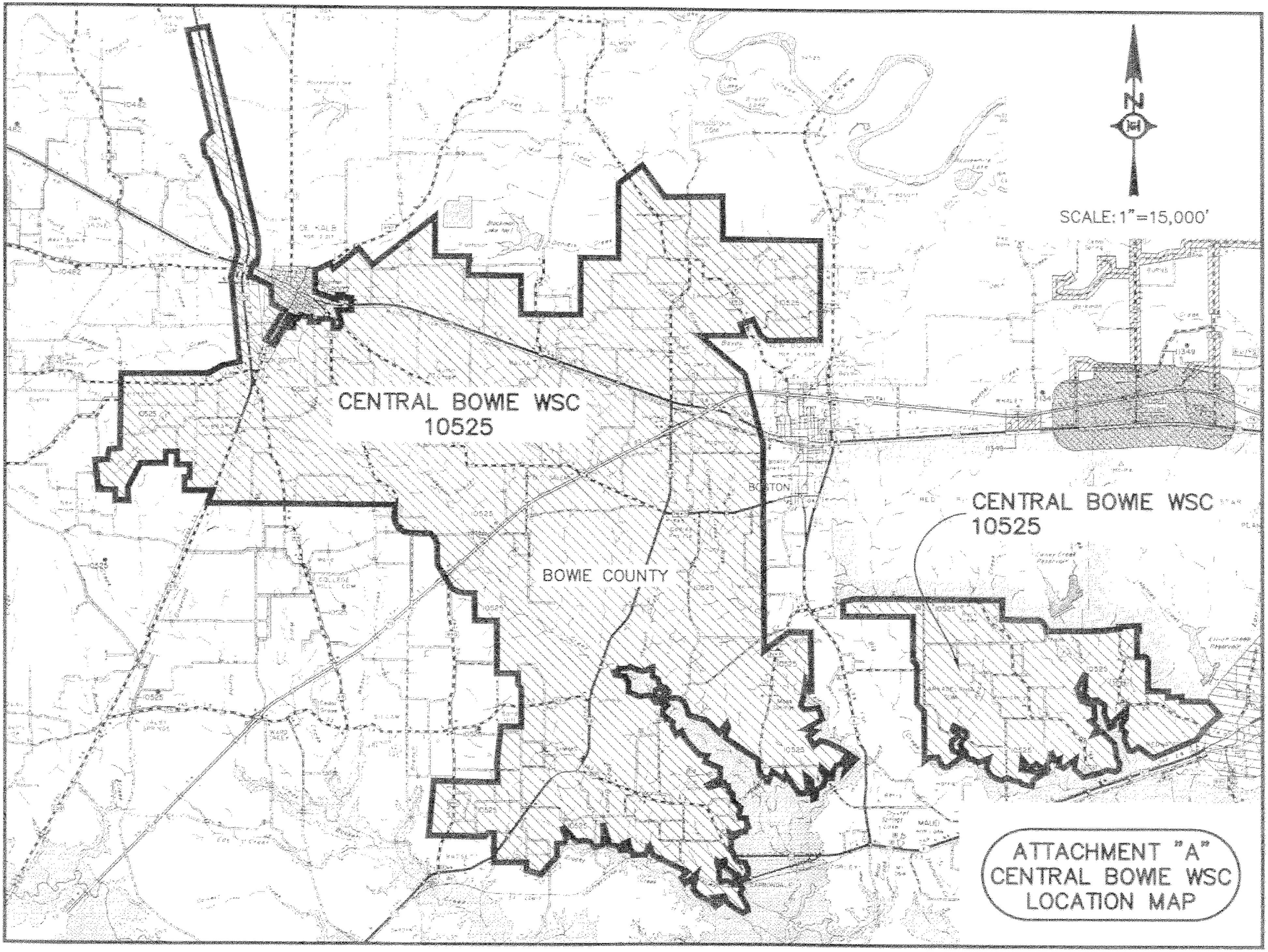
There were four alternative strategies considered to meet Central Bowie WSC's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the WSC is planning on continuing to purchase surface water from the City of Texarkana.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**369**	**$0**	**$141,941**	**$430**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	257	303	336	369	362	353

Surface water purchase from City of Texarkana is the recommended strategy to meet Central Bowie WSC's needs.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CENTRAL BOWIE WSC
10525
BOWIE COUNTY
BOSTON
CENTRAL BOWIE WSC
10525
ATTACHMENT "A"
CENTRAL BOWIE WSC
LOCATION MAP

Surface Water Worksheet
Central Bowie WSC
Bowie County

Water Purchase Contract With City of Texarkana:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
329,422	**369.0**	$ 1.32

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost		**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)		**1.0**
Other Capital Costs		
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)		$ -
ENVIRONMENTAL (LUMP SUM)		$ -
Total Borrowed Funds		**$ -**
INTEREST DURING CONSTRUCTION(IDC):	6% Annual Interest on Total Borrowed Funds	$ -
	4% Rate of Return on Investment of Unspent Funds	$ -
	Net Interest	**$ -**
TOTAL CAPITAL COST		**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	257	303	336	369	362	353	330
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 110,541.69	$ 130,327.37	$ 144,521.44	$ 158,715.51	$ 155,704.64	$ 151,833.53	$ 141,940.70
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 110,541.69**	**$ 130,327.37**	**$ 144,521.44**	**$ 158,715.51**	**$ 155,704.64**	**$ 151,833.53**	**$ 141,940.70**

UNIT COST
($ / ac-ft / yr) **$ 430.12**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF HOOKS IN BOWIE COUNTY

Description of Water User Group:

City of Hooks provides water service in Bowie County. The WUG population is projected to be 3,228 in 2010 and 3,775 in the year 2060. The city has a contract for water supply with the City of Texarkana for 463 ac-ft/yr. Hooks is projected to have a deficit of 81 ac-ft in 2010 and increasing to a deficit of 151 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	3228	3442	3609	3775	3775	3775
Projected Water Demand	416	443	465	486	486	486
Water Demand from other entities	128	128	128	128	128	128
Current Water Supply	463	463	463	463	463	463
Projected Supply Surplus (+) / Deficit (-)	**-81**	**-108**	**-130**	**-151**	**-151**	**-151**

Evaluation of Potentially Feasible Water Management Strategies:

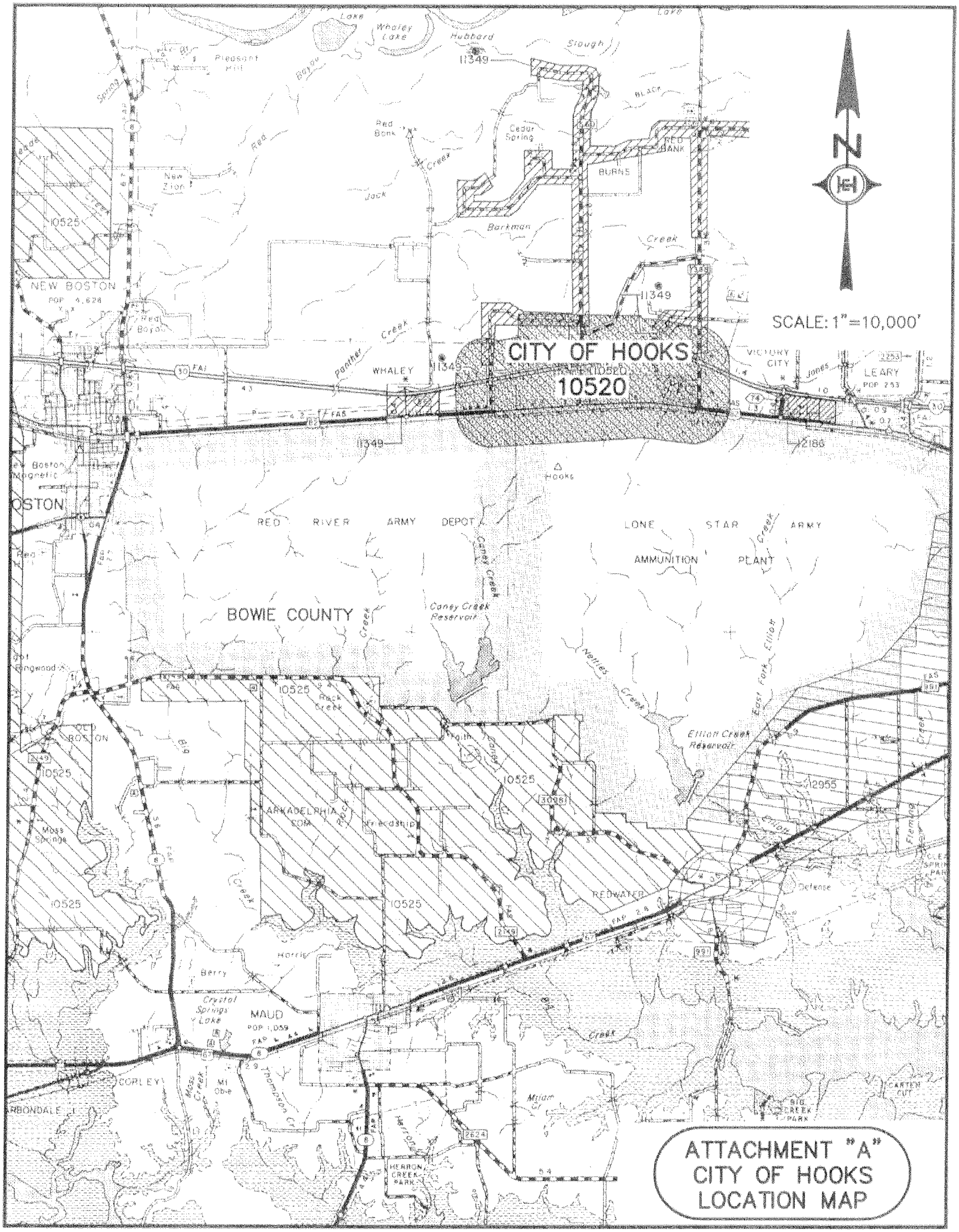
There were four alternative strategies considered to meet City of Hooks's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the city is planning on continuing to purchase surface water from the City of Texarkana.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**151**	**$0**	**$55,343**	**$430**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	81	108	130	151	151	151

Surface water purchase from City of Texarkana is the recommended strategy to meet City of Hooks's needs.



ATTACHMENT "A"
CITY OF HOOKS
LOCATION MAP

Surface Water Worksheet
City of Hooks
Bowie County

Water Purchase Contract With City of Texarkana:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
134,804	**151.0**	$ 1.32

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	81	108	130	151	151	151	129
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 34,839.99	$ 46,453.32	$ 55,916.03	$ 64,948.62	$ 64,948.62	$ 64,948.62	$ 55,342.53
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 34,839.99**	**$ 46,453.32**	**$ 55,916.03**	**$ 64,948.62**	**$ 64,948.62**	**$ 64,948.62**	Average **$ 55,342.53**

UNIT COST
($ / ac-ft / yr) **$ 430.12**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF MACEDONIA-EYLAU MUD#1 IN BOWIE COUNTY

Description of Water User Group:

Macedonia-Eylau MUD provides water service in Bowie County. The WUG population is projected to be 4,577 in 2010 and 5,205 in the year 2060. The MUD has a contract for water supply with the City of Texarkana for 552 ac-ft/yr. The MUD is projected to have a deficit of 217 ac-ft in 2010 and increasing to a deficit of 270 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	4577	4876	5096	5316	5260	5205
Projected Water Demand	769	803	822	846	831	822
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	552	552	552	552	552	552
Projected Supply Surplus (+) / Deficit (-)	**-217**	**-251**	**-270**	**-294**	**-279**	**-270**

Evaluation of Potentially Feasible Water Management Strategies:

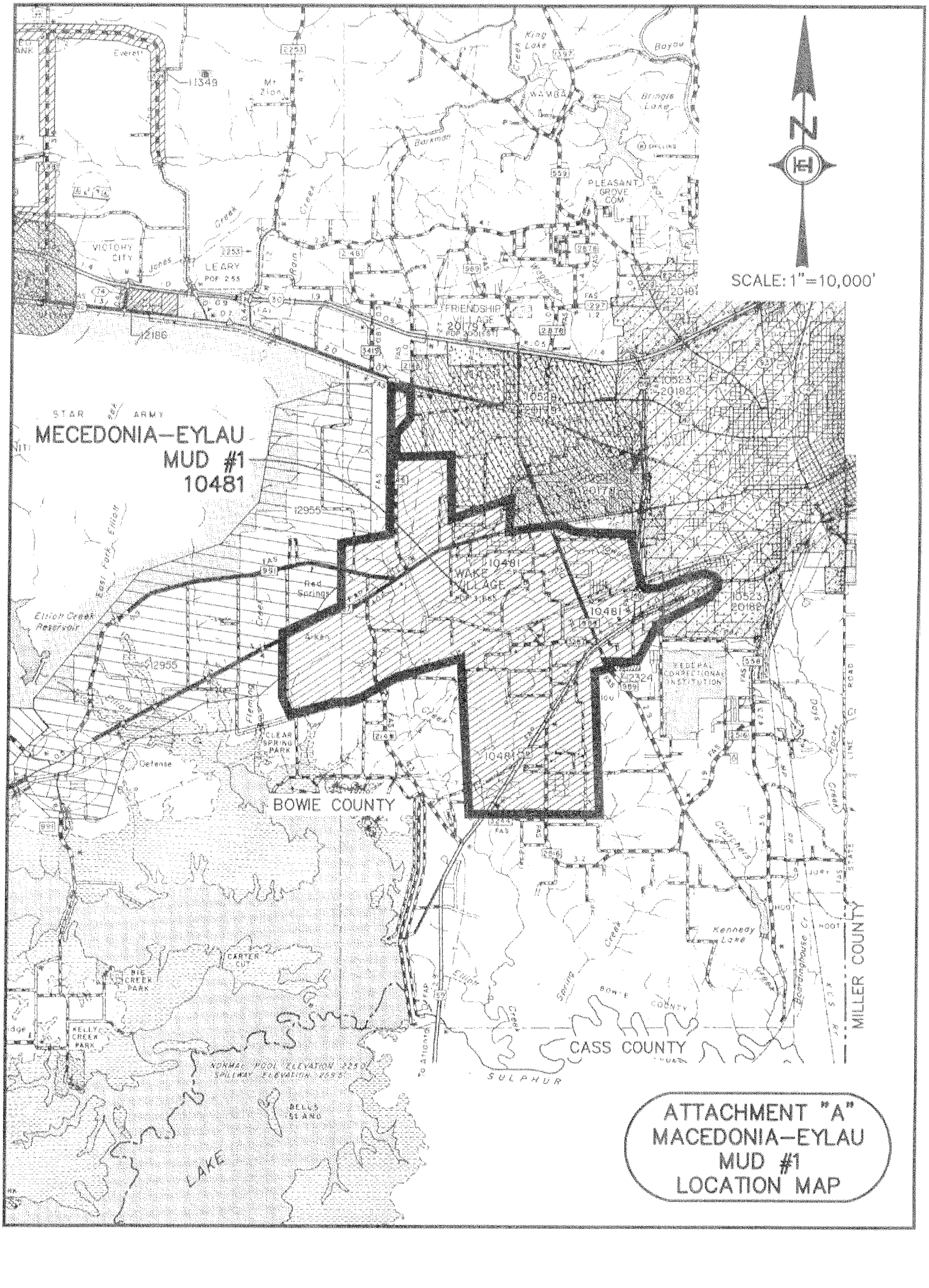
There were four alternative strategies considered to meet the MUD's water supply shortages as summarized in the Table below. Advanced conservation was considered because the per capita use per day was more than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the MUD is planning on continuing to purchase surface water from the City of Texarkana.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation	**42**	**276,610**	-	**$717**	**Minimal**
Water Reuse					
Ground Water					
Surface Water	**294**	**$0**	**$113,337**	**$430**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	217	251	270	294	279	270

Savings from water conservation is minimal and has a higher unit cost. Surface water purchase from City of Texarkana is the recommended strategy to meet Macedonia-Eylau MUD's needs.



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MECEDONIA–EYLAU
MUD #1
10481
WAKE VILLAGE
BOWIE COUNTY
CASS COUNTY
MILLER COUNTY
FEDERAL CORRECTIONAL INSTITUTION
FRIENDSHIP VILLAGE
LEARY
VICTORY CITY
PLEASANT GROVE COM
WAMBA
Red Springs
CLEAR SPRING PARK
Kennedy Lake
NORMAL POOL ELEVATION 225.0
SPILLWAY ELEVATION 259.5
LAKE
SULPHUR
ATTACHMENT "A"
MACEDONIA–EYLAU
MUD #1
LOCATION MAP

Surface Water Worksheet
Macedonia-Eylau MUD#1
Bowie County

Water Purchase Contract With City of Texarkana:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
262,466	**294.0**	$ 1.32

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	217	251	270	294	279	270	264
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 93,336.76	$ 107,960.95	$ 116,133.30	$ 126,456.26	$ 120,004.41	$ 116,133.30	$ 113,337.49
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 93,336.76**	**$ 107,960.95**	**$ 116,133.30**	**$ 126,456.26**	**$ 120,004.41**	**$ 116,133.30**	**$ 113,337.49**

UNIT COST
($ / ac-ft / yr) **$ 430.12**

Conservation Worksheet

Cost-Savings Analysis for Region D - Macedonia-EylauMUD#1

Regional Data	
Population	5,055
SF Population	5,055
MF Population	-
Institutional Population	-
SF Units	2,022
MF Units	-
Average Yearly Rainfall (inches)	45.3
SF Household Size	2.50
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	-
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
SF Toilet Retrofit	10.5	26.3	2.0	13.1	10%	50%	-	-	-	$ -	$ -	$ -	free or rebate
SF Showerheads and Aerators	5.5	13.8	2.0	6.9	10%	50%	-	-	-	$ -	$ -	$ -	kits picked up by customer
SF Clothes Washer Rebate	5.6	14.0	1.0	14.0	0%	90%	1,820	25,477	28.54	$ 120	$ 218,376	$ 815	rebate from water utility only
SF Irrigation Audit-High User	20.0	50.0	1.0	50.0	1%	5%	81	4,044	4.53	$ 70	$ 5,662	$ 459	staff
SF Rainwater Harvesting	19.9	49.8	1.0	49.8	0%	5%	101	5,039	5.64	$ 250	$ 25,275	$ 431	rebate
SF Rain Barrels	2.2	5.4	1.0	5.4	0%	30%	607	3,273	3.67	$ 45	$ 27,297	$ 717	rebate or distribution
MF Toilet Retrofit													
MF Showerheads and Aerators													
MF Clothes Washer Rebate													
MF Irrigation Audit													
MF Rainwater Harvesting													
								37,834	42		$ 276,610	$717.13	
Commercial													
Commercial Toilet Retrofit													
Coin-Operated Clothes Washer Rebate													
Irrigation Audit													
Commercial General Rebate													
Commercial Rainwater Harvesting													

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF NEW BOSTON IN BOWIE COUNTY

Description of Water User Group:

City of New Boston provides water service in Bowie County. The WUG population is projected to be 5,219 in 2010 and 6,105 in the year 2060. The city has a contract for water supply with the City of Texarkana for 1090 ac-ft/yr. New Boston is projected to have a deficit of 45 ac-ft in 2010 and increasing to a deficit of 168 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	5219	5567	5836	6105	6105	6105
Projected Water Demand	1135	1191	1229	1265	1258	1258
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	1090	1090	1090	1090	1090	1090
Projected Supply Surplus (+) / Deficit (-)	**-45**	**-101**	**-139**	**-175**	**-168**	**-168**

Evaluation of Potentially Feasible Water Management Strategies:

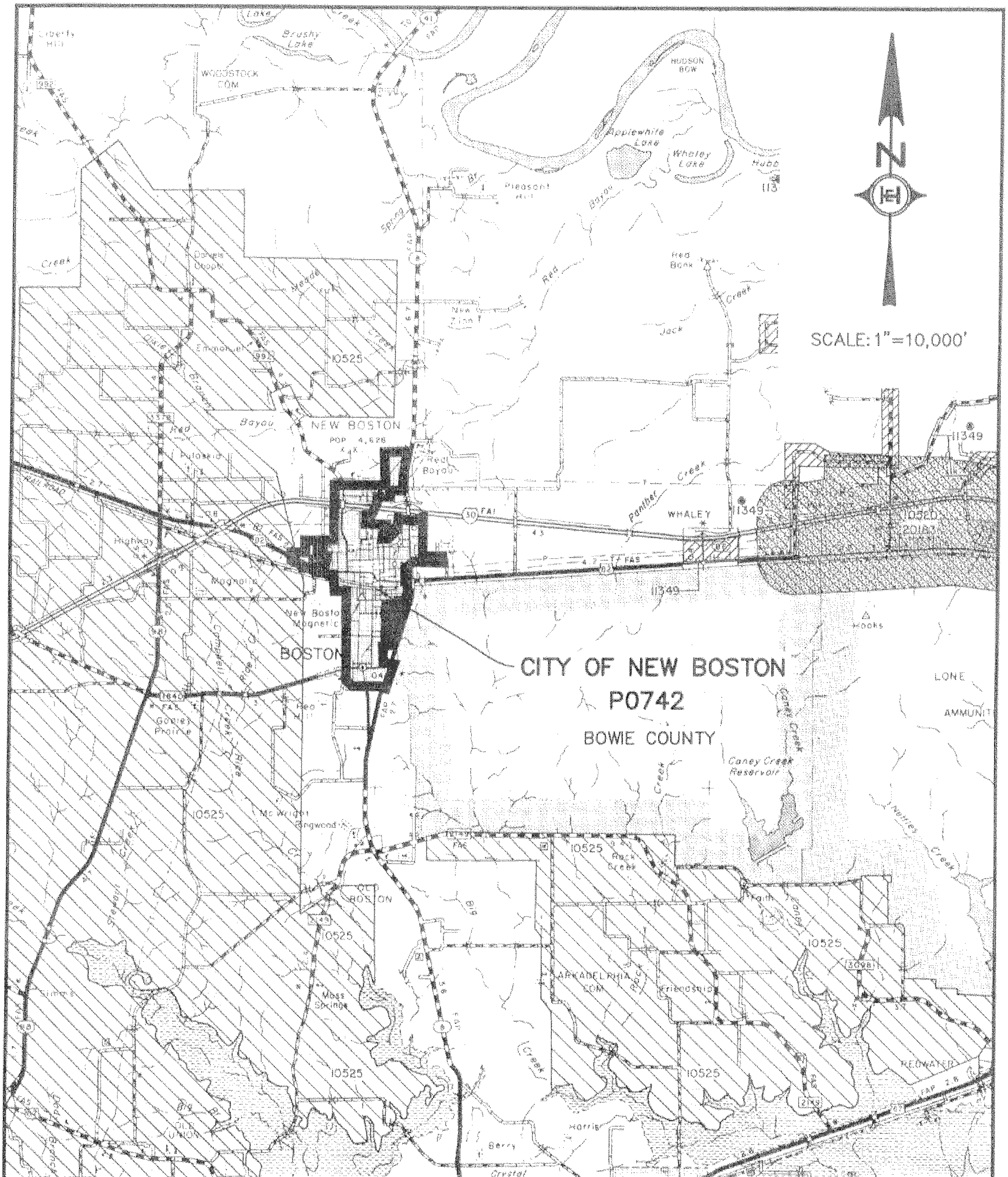
There were four alternative strategies considered to meet New Boston's water supply shortages as summarized in the Table below. Advanced conservation was considered because the per capita use per day was more than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the city is planning on continuing to purchase surface water from the City of Texarkana.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation	**24**	**$159,290**	-	**$717**	**Minimal**
Water Reuse					
Ground Water					
Surface Water	**175**	**$0**	**$57,063**	**$430**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	45	101	139	175	168	168

Savings from water conservation is minimal and has a higher unit cost. Surface water purchase from City of Texarkana is the recommended strategy to meet City of New Boston's needs.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CITY OF NEW BOSTON
P0742
BOWIE COUNTY
NEW BOSTON
MAUD
ATTACHMENT "A"
CITY OF NEW BOSTON
LOCATION MAP

Surface Water Worksheet
City of New Boston
Bowie County

Water Purchase Contract With City of Texarkana:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
156,230	**175.0**	$ 1.32

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	45	101	139	175	168	168	133
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 19,355.55	$ 43,442.46	$ 59,787.14	$ 75,271.58	$ 72,260.72	$ 72,260.72	$ 57,063.03
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 19,355.55**	**$ 43,442.46**	**$ 59,787.14**	**$ 75,271.58**	**$ 72,260.72**	**$ 72,260.72**	**$ 57,063.03**

UNIT COST
($ / ac-ft / yr) **$ 430.12**

Conservation Worksheet

Cost-Savings Analysis for Region D - City of New Boston

Regional Data	
Population	2,911
SF Population	2,911
MF Population	-
Institutional Population	-
SF Units	1,164
MF Units	-
Average Yearly Rainfall (inches)	45.3
SF Household Size	2.50
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	-
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit	10.5	26.3	2.0	13.1	10%	50%	-	-	-	$ -	$ -	$ -	free or rebate
SF Showerheads and Aerators	5.5	13.8	2.0	6.9	10%	50%	-	-	-	$ -	$ -	$ -	kits picked up by customer
SF Clothes Washer Rebate	5.6	14.0	1.0	14.0	0%	90%	1,048	14,671	16.43	$ 120	$ 125,755	$ 815	rebate from water utility only
SF Irrigation Audit-High User	20.0	50.0	1.0	50.0	1%	5%	47	2,329	2.61	$ 70	$ 3,260	$ 459	staff
SF Rainwater Harvesting	19.9	49.8	1.0	49.8	0%	5%	58	2,902	3.25	$ 250	$ 14,555	$ 431	rebate
SF Rain Barrels	2.2	5.4	1.0	5.4	0%	30%	349	1,885	2.11	$ 45	$ 15,719	$ 717	rebate or distribution
MF Toilet Retrofit													
MF Showerheads and Aerators													
MF Clothes Washer Rebate													
MF Irrigation Audit													
MF Rainwater Harvesting													
								21,787	24		$ 159,290	$717.13	
Commercial													
Commercial Toilet Retrofit													
Coin-Operated Clothes Washer Rebate													
Irrigation Audit													
Commercial General Rebate													
Commercial Rainwater Harvesting													

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF RED WATER IN BOWIE COUNTY

Description of Water User Group:

City of Red Water provides water service in Bowie County. The WUG population is projected to be 2,489 in 2010 and 2,861 in the year 2060. The city has a contract for water supply with the City of Texarkana for 147 ac-ft/yr. The city also has a well that produces 73 ac-ft/yr. The city is projected to have a deficit of 146 ac-ft in 2010 and increasing to a deficit of 171 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	2489	2653	2775	2898	2880	2861
Projected Water Demand	352	365	373	384	380	377
Water Demand from other entities	14	14	14	14	14	14
Current Water Supply	220	220	220	220	220	220
Projected Supply Surplus (+) / Deficit (-)	**-146**	**-159**	**-167**	**-178**	**-174**	**-171**

Evaluation of Potentially Feasible Water Management Strategies:

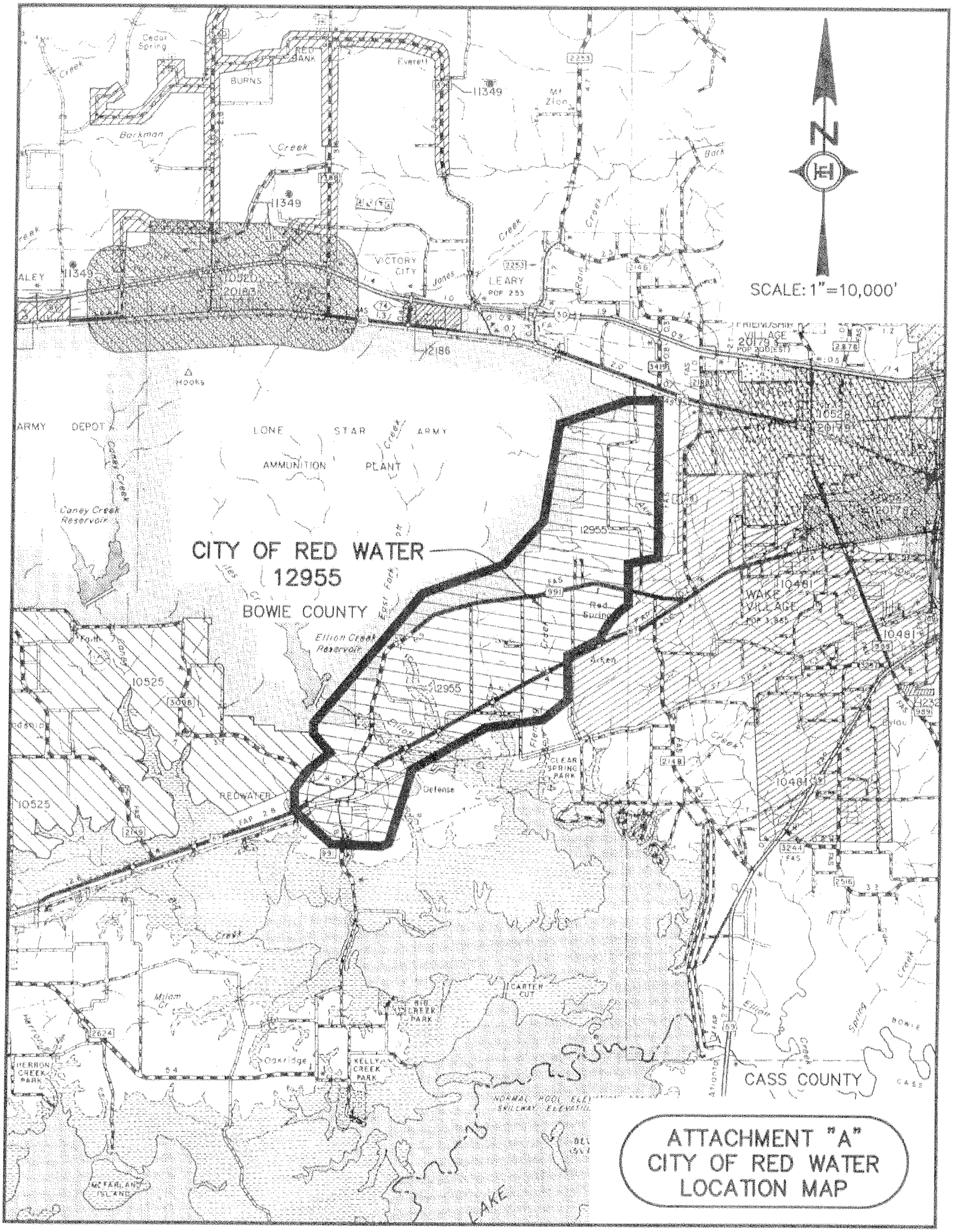
There were four alternative strategies considered to meet the City of Red Water's supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the city is planning on continuing to purchase surface water from the City of Texarkana.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**178**	**$0**	**$71,329**	**$430**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	**146**	**159**	**167**	**178**	**174**	**171**

Surface water purchase from City of Texarkana is the recommended strategy to meet City of Red Water's needs.



SCALE: 1"=10,000'
N
CITY OF RED WATER
12955
BOWIE COUNTY
LONE STAR ARMY AMMUNITION PLANT
ARMY DEPOT
Caney Creek Reservoir
Elliott Creek Reservoir
REDWATER
Hooks
VICTORY CITY
LEARY
BURNS
WAKE VILLAGE
Defense
CLEAR SPRING PARK
BIG CREEK PARK
KELLY CREEK PARK
CARTER CUT
Oakridge
MCFARLAND ISLAND
CASS COUNTY
LAKE
10525
11349
12955
10481
ATTACHMENT "A"
CITY OF RED WATER
LOCATION MAP

Surface Water Worksheet
City of Red Water
Bowie County

Water Purchase Contract With City of Texarkana:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
158,908	**178.0**	$ 1.32

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	146	159	167	178	174	171	166
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 62,798.00	$ 68,389.61	$ 71,830.59	$ 76,561.95	$ 74,841.46	$ 73,551.09	$ 71,328.78
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 62,798.00**	**$ 68,389.61**	**$ 71,830.59**	**$ 76,561.95**	**$ 74,841.46**	**$ 73,551.09**	**$ 71,328.78**

UNIT COST
($ / ac-ft / yr) **$ 430.12**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF WAKE VILLAGE IN BOWIE COUNTY

Description of Water User Group:

City of Wake Village provides water service in Bowie County. The WUG population is projected to be 5,546 in 2010 and 7,784 in the year 2060. The city has a contract for water supply with the City of Texarkana for 358 ac-ft/yr. Wake Village is projected to have a deficit of 356 ac-ft in 2010 and increasing to a deficit of 645 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	5546	5993	6441	6888	7336	7784
Projected Water Demand	714	772	830	887	945	1003
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	358	358	358	358	358	358
Projected Supply Surplus (+) / Deficit (-)	**-356**	**-414**	**-472**	**-529**	**-587**	**-645**

Evaluation of Potentially Feasible Water Management Strategies:

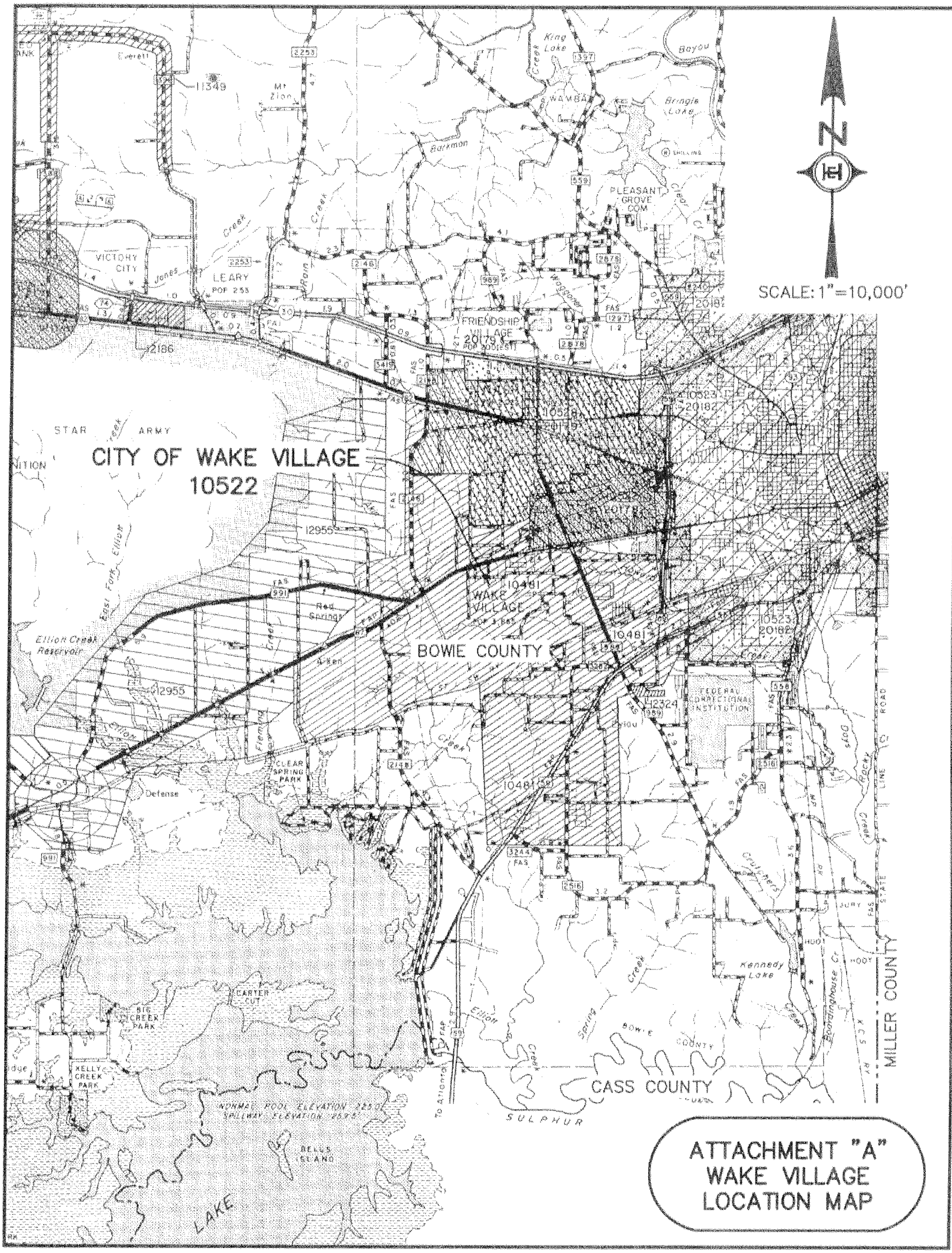
There were four alternative strategies considered to meet Wake Village's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the city is planning on continuing to purchase surface water from the City of Texarkana.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**645**	**$0**	**$215,277**	**$430**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	356	414	472	529	587	645

Surface water purchase from City of Texarkana is the recommended strategy to meet City of Wake Village's needs.



SCALE: 1"=10,000'
CITY OF WAKE VILLAGE
10522
BOWIE COUNTY
CASS COUNTY
MILLER COUNTY
WAKE VILLAGE
FRIENDSHIP VILLAGE
LEARY
VICTORY CITY
WAMBA
PLEASANT GROVE COM
FEDERAL CORRECTIONAL INSTITUTION
CLEAR SPRING PARK
BIG CREEK PARK
KELLY CREEK PARK
CARTER CUT
NORMAL POOL ELEVATION 225.0
SPILLWAY ELEVATION 259.5
SULPHUR
LAKE
To Atlanta
ATTACHMENT "A"
WAKE VILLAGE
LOCATION MAP

Surface Water Worksheet
City of Wake Village
Bowie County

Water Purchase Contract With City of Texarkana:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
575,819	**645.0**	$ 1.32

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	356	414	472	529	587	645	501
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 153,123.90	$ 178,071.05	$ 203,018.21	$ 227,535.24	$ 252,482.39	$ 277,429.54	$ 215,276.72

	2010	2020	2030	2040	2050	2060	Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 153,123.90**	**$ 178,071.05**	**$ 203,018.21**	**$ 227,535.24**	**$ 252,482.39**	**$ 277,429.54**	**$ 215,276.72**

UNIT COST
($ / ac-ft / yr) **$ 430.12**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF BURNS REDBANK WATER SUPPLY CORPORATION IN BOWIE COUNTY

Description of Water User Group:

Burns RedBank WSC provides water service in Bowie County. The WUG population is projected to be 1,407 in 2010 and 1,600 in the year 2060. The WSC has a contract for water supply with the City of Hooks for 129 ac-ft/yr. The WSC is projected to have a deficit of 91 ac-ft in 2010 and increasing to a deficit of 103 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	1407	1499	1567	1635	1618	1600
Projected Water Demand	220	229	234	239	235	232
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	129	129	129	129	129	129
Projected Supply Surplus (+) / Deficit (-)	**-91**	**-100**	**-106**	**-110**	**-106**	**-103**

Evaluation of Potentially Feasible Water Management Strategies:

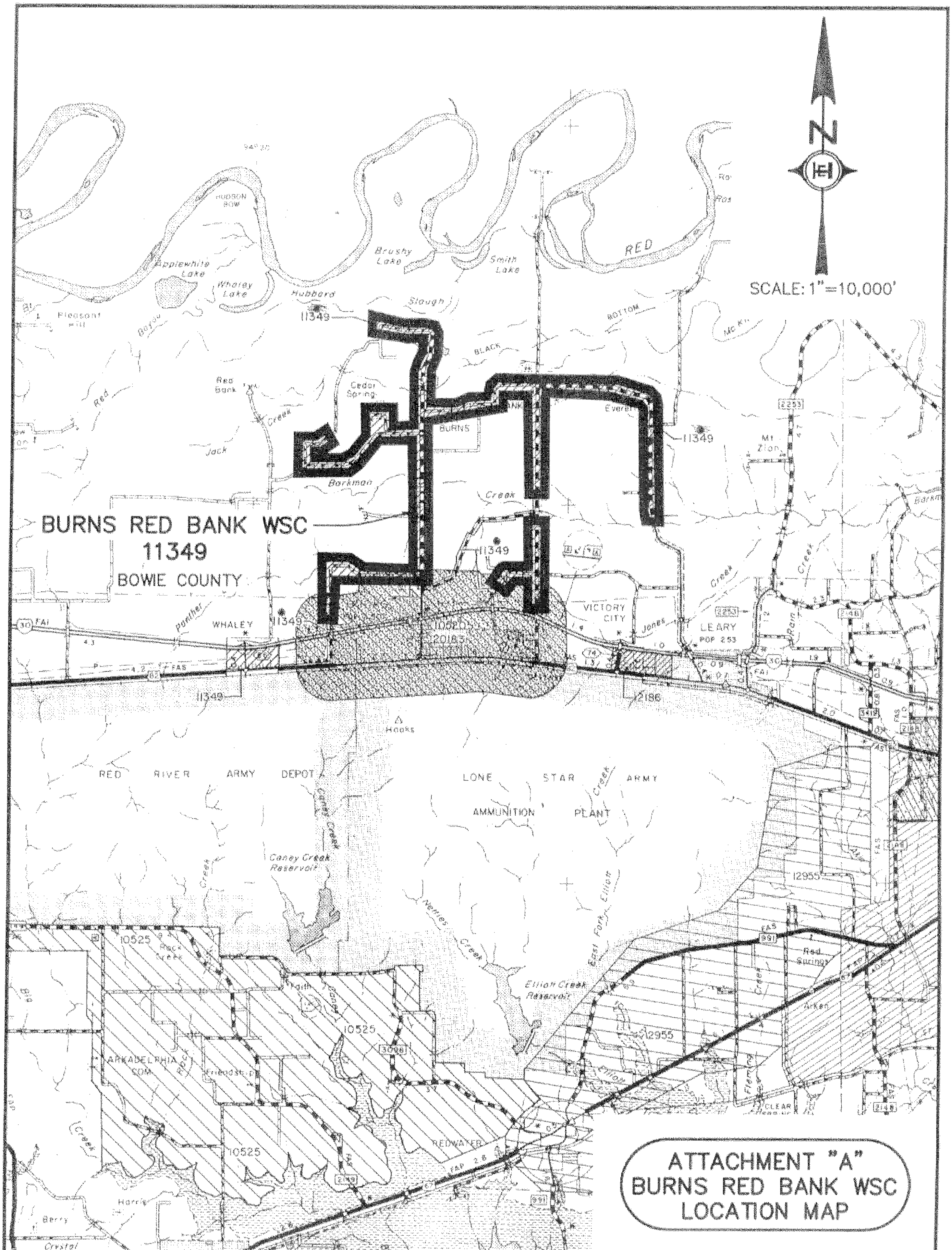
There were four alternative strategies considered to meet the WSC's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the WSC is planning on continuing to purchase surface water from the City of Hooks.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**110**	**$0**	**$44,159**	**$430**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	91	100	106	110	106	103

Surface water purchase from City of Hooks is the recommended strategy to meet Burns RedBank WSC's needs.



ATTACHMENT "A"
BURNS RED BANK WSC
LOCATION MAP

Surface Water Worksheet
Burns RedBank WSC
Bowie County

Water Purchase Contract With City of Hooks:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
98,202	**110.0**	$ 1.32

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	91	100	106	110	106	103	103
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 39,141.22	$ 43,012.33	$ 45,593.07	$ 47,313.57	$ 45,593.07	$ 44,302.70	$ 44,159.33
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 39,141.22**	**$ 43,012.33**	**$ 45,593.07**	**$ 47,313.57**	**$ 45,593.07**	**$ 44,302.70**	**$ 44,159.33**

UNIT COST
($ / ac-ft / yr) **$ 430.12**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF OAK GROVE WATER SUPPLY CORPORATION IN BOWIE COUNTY

Description of Water User Group:

Oak Grove WSC provides water service in Bowie County and Red River County. The WUG population is projected to be 703 in 2010 and 791 in the year 2060. The WSC has a contract for water supply with the City of Texarkana for 74 ac-ft/yr. The WSC is projected to have a deficit of 31 ac-ft in 2010 and increasing to a deficit of 36 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	703	745	775	806	798	791
Projected Water Demand	105	109	111	113	111	110
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	74	74	74	74	74	74
Projected Supply Surplus (+) / Deficit (-)	**-31**	**-35**	**-37**	**-39**	**-37**	**-36**

Evaluation of Potentially Feasible Water Management Strategies:

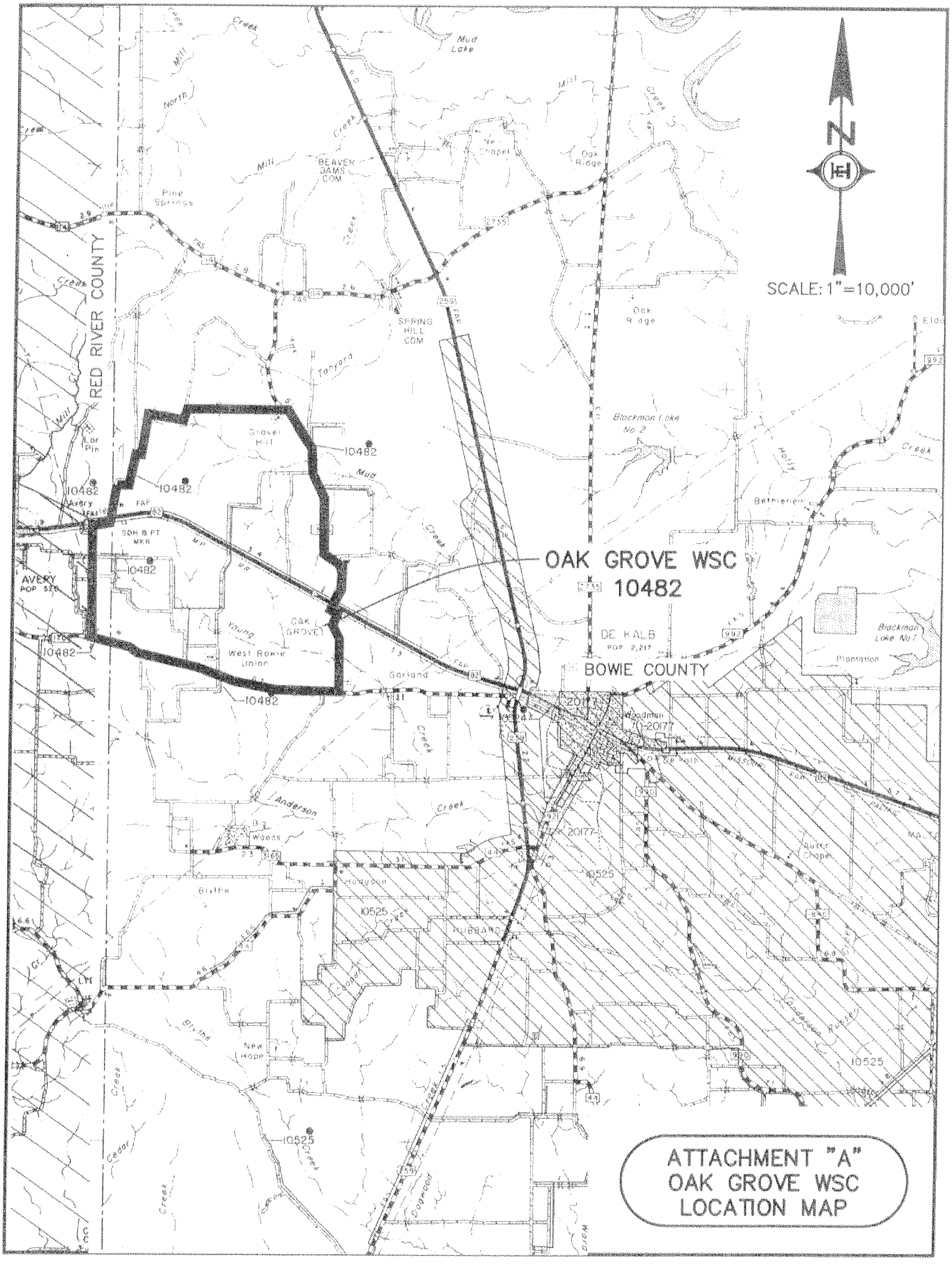
There were four alternative strategies considered to meet the WSC's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the WSC is planning on continuing to purchase surface water from the City of Texarkana.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**39**	**$0**	**$15,413**	**$430**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	31	35	37	39	37	36

Surface water purchase from City of Texarkana is the recommended strategy to meet Oak Grove WSC's needs.


SCALE: 1"=10,000'
OAK GROVE WSC
10482
RED RIVER COUNTY
BOWIE COUNTY
AVERY
DE KALB
10525
20177
ATTACHMENT "A"
OAK GROVE WSC
LOCATION MAP

Surface Water Worksheet
Oak Grove WSC
Bowie County

Water Purchase Contract With City of Texarkana:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
34,817	**39.0**	$ 1.32

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	31	35	37	39	37	36	36
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 13,333.82	$ 15,054.32	$ 15,914.56	$ 16,774.81	$ 15,914.56	$ 15,484.44	$ 15,412.75
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 13,333.82**	**$ 15,054.32**	**$ 15,914.56**	**$ 16,774.81**	**$ 15,914.56**	**$ 15,484.44**	**$ 15,412.75**

UNIT COST
($ / ac-ft / yr) **$ 430.12**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF RED RIVER REDEVELOPMENT AUTHORITY IN BOWIE COUNTY

Description of Water User Group:

The Red River Redevelopment Authority (RRRA) is an instrumentality of and political sub-division of the State of Texas. The RRRA operates and maintains the wet utilities at the Red River Commerce Park (RRCP) and Red River Army Depot (RRAD) and is located in New Boston, Texas (Bowie County). The Commerce Park and RRAD are approximately 17 miles west of Texarkana, Texas.

The RRRA was formed as a direct result of the 1995 Base Realignment and Closure (BRAC) as part of the Department of Defense's goal to privatize utility systems. Approximately 700 acres, many buildings, and all of the wet utility systems have been transferred over to the RRRA. The RRRA's charter is to attract new industry and jobs to the Commerce Park in addition to providing reliable wet utility services to both the Depot and commercial clients.

The RRRA water system consists of a 3 MGD water treatment plant and water distribution lines and appurtenances within the Depot and the Commerce Park. The water sources are Caney Creek Lake and Elliott Creek Lake. Both lakes are within the boundaries of RRAD and were built to support the RRAD mission. The combined capacity of both lakes is 4,074 acre-feet.

The Red River Redevelopment Authority requests that the Regional Water Plan be revised to reflect the water allocation needs of RRRA to support the Red River Army Depot's mission and to attract new industrial and commercial clients. The 50-year allocation requirement for RRRA is listed below.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Projected Water Demand	1343	1890	2435	2981	3527	4074
Current Water Supply	0	0	0	0	0	0
Projected Supply Surplus (+)/Deficit(-)	**-1343**	**-1890**	**-2435**	**-2981**	**-3527**	**-4074**

Evaluation of Potentially Feasible Water Management Strategies:

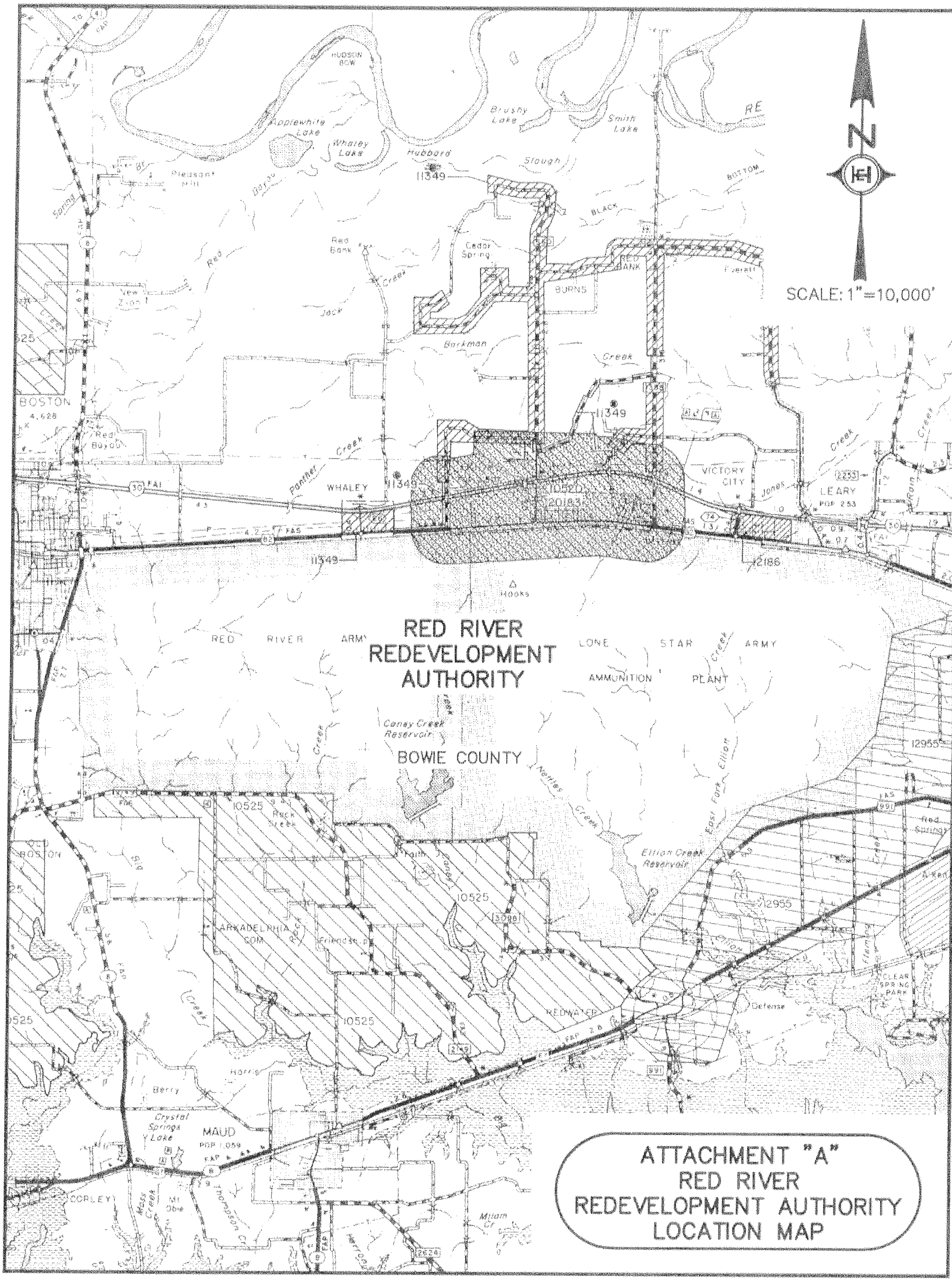
RRRA's objective is to acquire a surface water right permit, from TCEQ, to utilize surface water from Caney Creek Lake and Elliott Creek Lake in Bowie County. Consequently, only surface water was considered as a viable alternative to meet projected demands. A surface water worksheet is included as Attachment A.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**4,074**	-	-	**$50,000**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	**1343**	**1890**	**2435**	**2981**	**3527**	**4074**

The recommended strategy for the Red River Redevelopment Authority to meet projected demands during the planning period is to utilize surface water from Caney Creek Lake and Elliott Creek Lake in Bowie County.



ATTACHMENT "A"
RED RIVER
REDEVELOPMENT AUTHORITY
LOCATION MAP

Attachment A - Surface Water worksheet
Red River Redevelopment Authority
Bowie County

Surface Water from Caney Lake and Elliot Creek Lake

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
3,637,033	**4074**	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	-
<u>Other Capital Costs</u>	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 50,000.00
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ 50,000.00**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ 50,000.00**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	1343	1890	2435	2981	3527	4074	2,708
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 50,000.00**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 50,000.00**

UNIT COST
($ / ac-ft / yr) **$ 50,000.00**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

CAMP COUNTY

WUGs:

Bi-County WSC

County Other:

Woodland Harbor

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF BI-COUNTY WATER SUPPLY CORPORATION IN CAMP COUNTY

Description of Water User Group:

Bi-County WSC provides water service in Camp, Morris, Titus and Upshur Counties. The WUG population in Camp County is projected to be 5,694 in 2010 and 11,205 in the year 2060. Bi-County relies on twenty-four wells in the Carrizo-Wilcox Aquifer with a total rated pumping capacity of approximately 2,761 gpm, or 1,485 ac-ft/yr. The portion of water supply available to the users in Camp County was estimated as 1,470 gpm or 790 ac-ft/yr. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	5694	7127	8452	9501	10314	11205
Projected Water Demand	733	918	1089	1224	1329	1443
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	790	790	790	790	790	790
Projected Supply Surplus (+) / Deficit (-)	**57**	**-128**	**-299**	**-434**	**-539**	**-653**

Evaluation of Potentially Feasible Water Management Strategies:

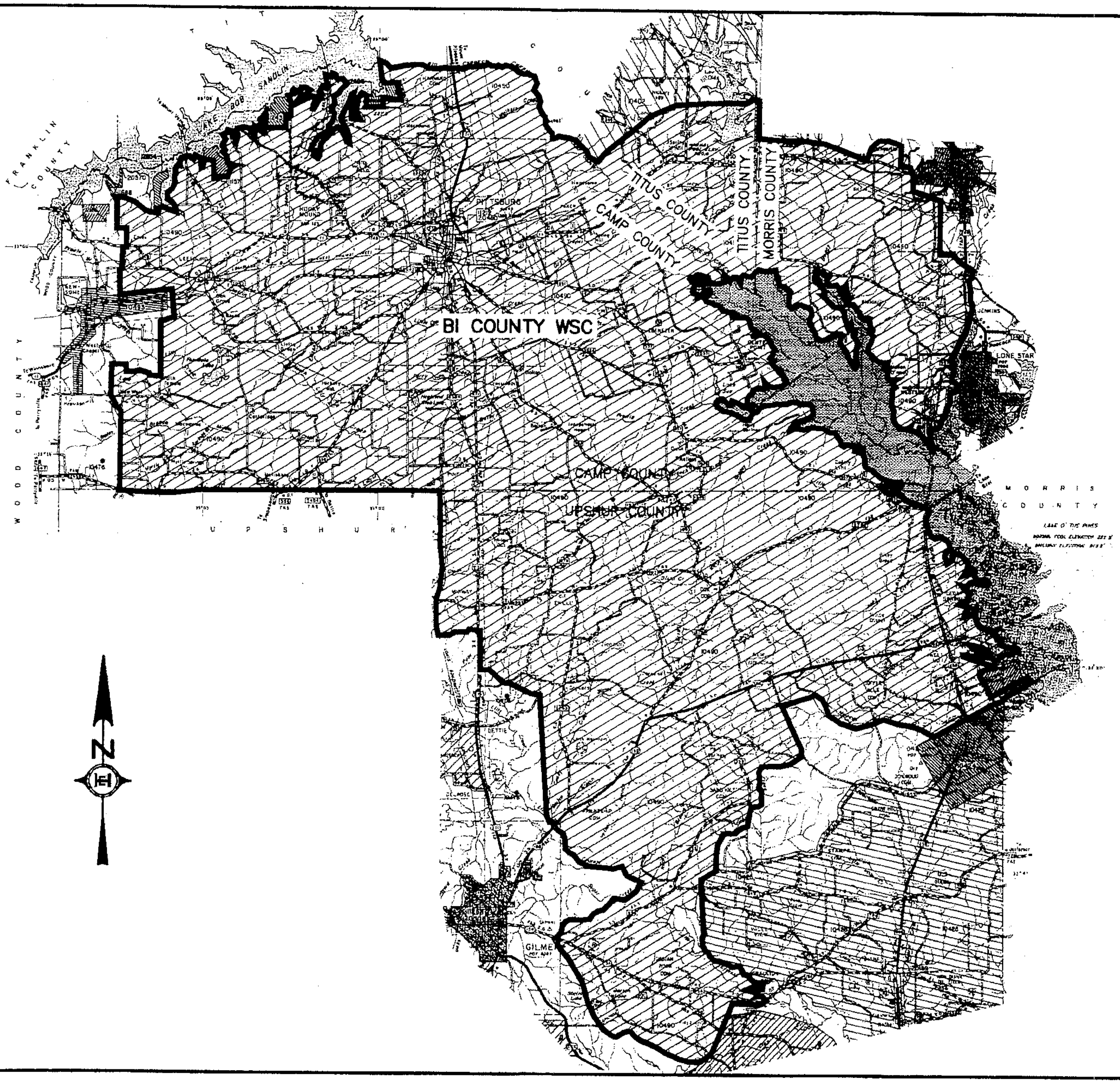
There were four alternative strategies considered to meet Bi-County's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because there is no centralized wastewater collection system. Groundwater was not selected because the WSC is planning on acquiring surface water from the Northeast Texas Municipal Water District. A surface water purchase worksheet has been included as Attachment B.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**653**	**$44,169**	**$224,594**	**$656**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)		128	299	434	539	653

Surface water from Northeast Texas MWD is the recommended strategy to meet Bi-County's needs. Construction of infrastructure to convey water from the Northeast Texas MWD to the WSC is expected to begin before the end of 2005, and the source of the surface water will be Lake Bob Sandlin in the Cypress Creek basin.



ATTACHMENT "A"
BI COUNTY WSC
LOCATION MAP

Attachment B - Surface Water worksheet
Bi-County WSC
Hunt County

Water Purchase Contract With Northeast Texas Municipal Water District:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
582,961	**653.0**	$ 2.00

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
1,000	10	$ 1.67	$ 16,700.00	$ 584.50	$ 17,284.50

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 17,284.50**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 5,185.35
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 42,469.85**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 2,548.19
4% Rate of Return on Investment of Unspent Funds	$ 849.40
Net Interest	**$ 1,698.79**
TOTAL CAPITAL COST	**$ 44,168.64**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	128	299	434	539	653	342
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ 83,417.86	$ 194,858.90	$ 282,838.67	$ 351,267.38	$ 425,561.41	$ 222,990.70
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 3,206.64**	**$ 86,624.50**	**$ 198,065.54**	**$ 282,838.67**	**$ 351,267.38**	**$ 425,561.41**	**$ 224,594.02**

UNIT COST
($ / ac-ft / yr) **$ 656.39**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF WOODLAND HARBOR

Description of Water User Group:

Woodland Harbor, which is within the County Other systems in Camp County, is a small water system located in north Camp County. The system serves 588 people and is not projected to grow over the planning period. The current source of supply is a single well into the Carrizo-Wilcox with a tested capacity of 30 gpm. No sustained decline in water quantity or quality has been experienced in the existing well. Woodland Harbor is projected to have a water supply deficit of 60 ac-ft/yr beginning 2010. The system does not have either a water conservation plan or a drought management plan.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	588	588	588	588	588	588
Projected Water Demand	76	76	76	76	76	76
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	16	16	16	16	16	16
Projected Supply Surplus (+) / Deficit (-)	**-60**	**-60**	**-60**	**-60**	**-60**	**-60**

Evaluation of Potentially Feasible Water Management Strategies:

The four alternative strategies considered to meet Woodland Harbor's water supply shortages are listed in the table below. Advanced conservation was not selected since per capita use is less than 140 gpcpd. Reuse is not a feasible option because there is no centralized wastewater collection system. Surface water alternatives were omitted since surface water treatment is not economically feasible for a system of this size. Groundwater from the Carrizo-Wilcox Aquifer was the alternative selected for this entity.

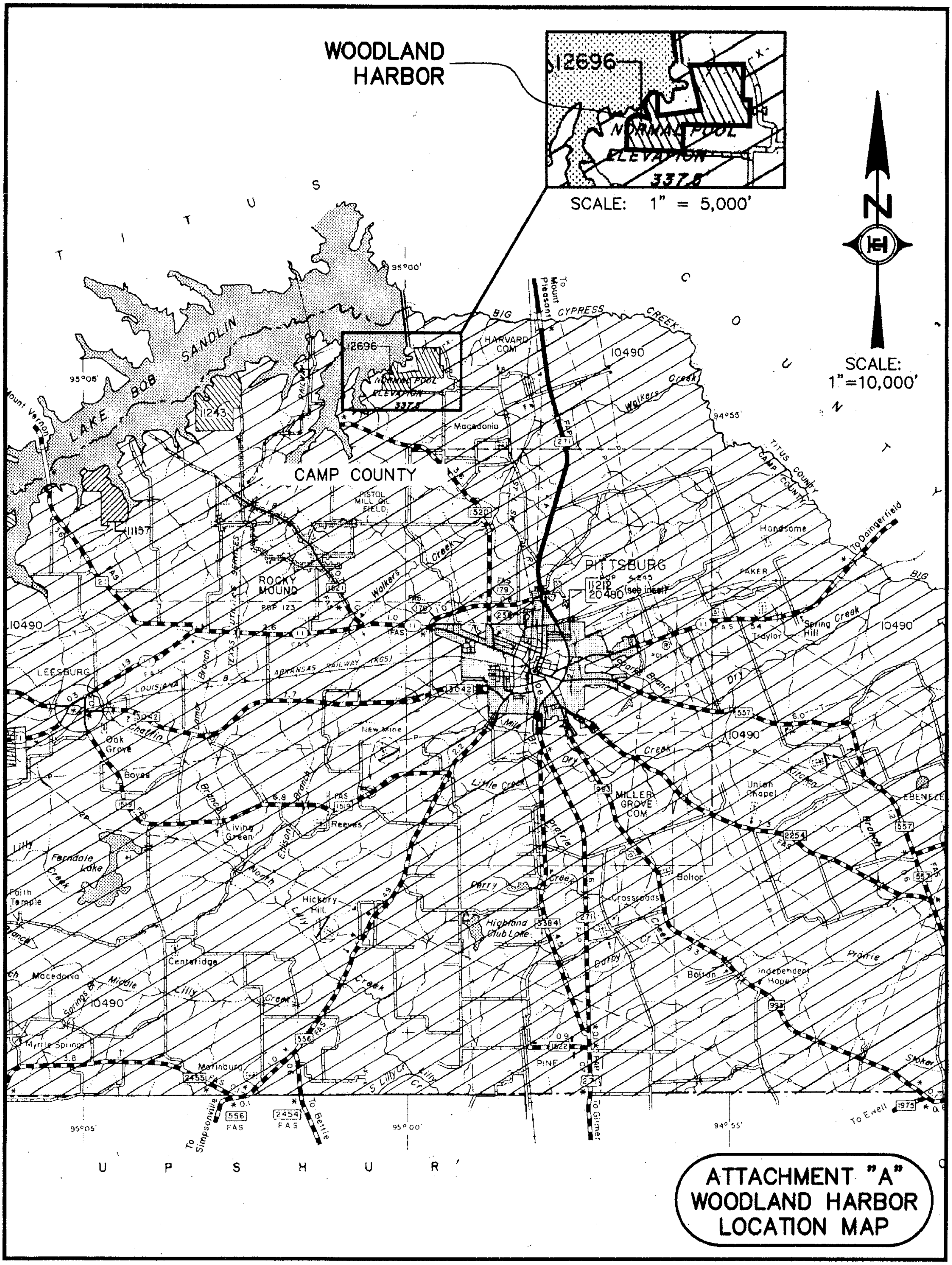
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**65**	**$775,872**	**$66,928**	**$596**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	65	65	65	65	65	65

The recommended strategy for Woodland Harbor to meet their projected deficit in 2010 is to construct two new wells into the Carrizo-Wilcox with a rated capacity of 60 gpm each, which would provide a total of 65 ac-ft/yr. Supply from these additional wells is sufficient to meet Woodland Harbor needs till 2060.

Additional storage is needed to meet the TCEQ's total storage requirement of 200 gallons/connection. This translates to a total storage of approximately 0.040 MG for the existing 200 connections. The existing system does not meet this requirement since it only has a total storage of 0.010 MG. An additional 0.030 MG of ground storage should be constructed as part of the project.



ATTACHMENT "A"
WOODLAND HARBOR
LOCATION MAP

Attachment B - Groundwater worksheet
Woodland Harbor
Camp County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
2	700	60	**65**	$ 334.00	$ 467,600.00	$ 4,676.00	$ 472,276.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
5,000	6	$ 2.23	$ 66,900.00	$ 2,341.50	$ 69,241.50

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
1	30000	$ 0.56	$ 16,800.00	$ 168.00	$ 16,968.00

Total Construction Cost	**$ 558,485.50**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 167,545.65
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 746,031.15**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 44,761.87
4% Rate of Return on Investment of Unspent Funds	$ 14,920.62
Net Interest	**$ 29,841.25**
TOTAL CAPITAL COST	**$ 775,872.40**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 9,461.34

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	60	150	70%	2	0.06	$ 1,138.81

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 66,928.49**
WUG Total WMS Cost Per Acre-Foot	**$ 596.37**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

CASS COUNTY

WUGs:

City of Linden

County Other:

None

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF THE CITY OF LINDEN

Description of Water User Group:

The City of Linden is located in central Cass County. In 2003, the City served 954 connections. The City is expected to grow from a current population of 2,297 persons in 2010 to 2,575 persons by the year 2060. The City of Linden is included in the City WUG for Cass County. The City relies on ground water from four water wells. The four water wells produce a cumulative total of approximately 475 GPM, or 255 ac-ft/yr. The City does not have a water conservation plan or a drought management plan. The system is bounded on all sides by the Western Cass WSC. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	2297	2390	2482	2575	2575	2575
Projected Water Demand	347	353	356	361	359	359
Current Water Supply	255	255	255	255	255	255
Projected Supply Surplus(+)/Deficit(-)	**-92**	**-98**	**-101**	**-106**	**-104**	**-104**

Evaluation of Potentially Feasible Water Management Strategies:

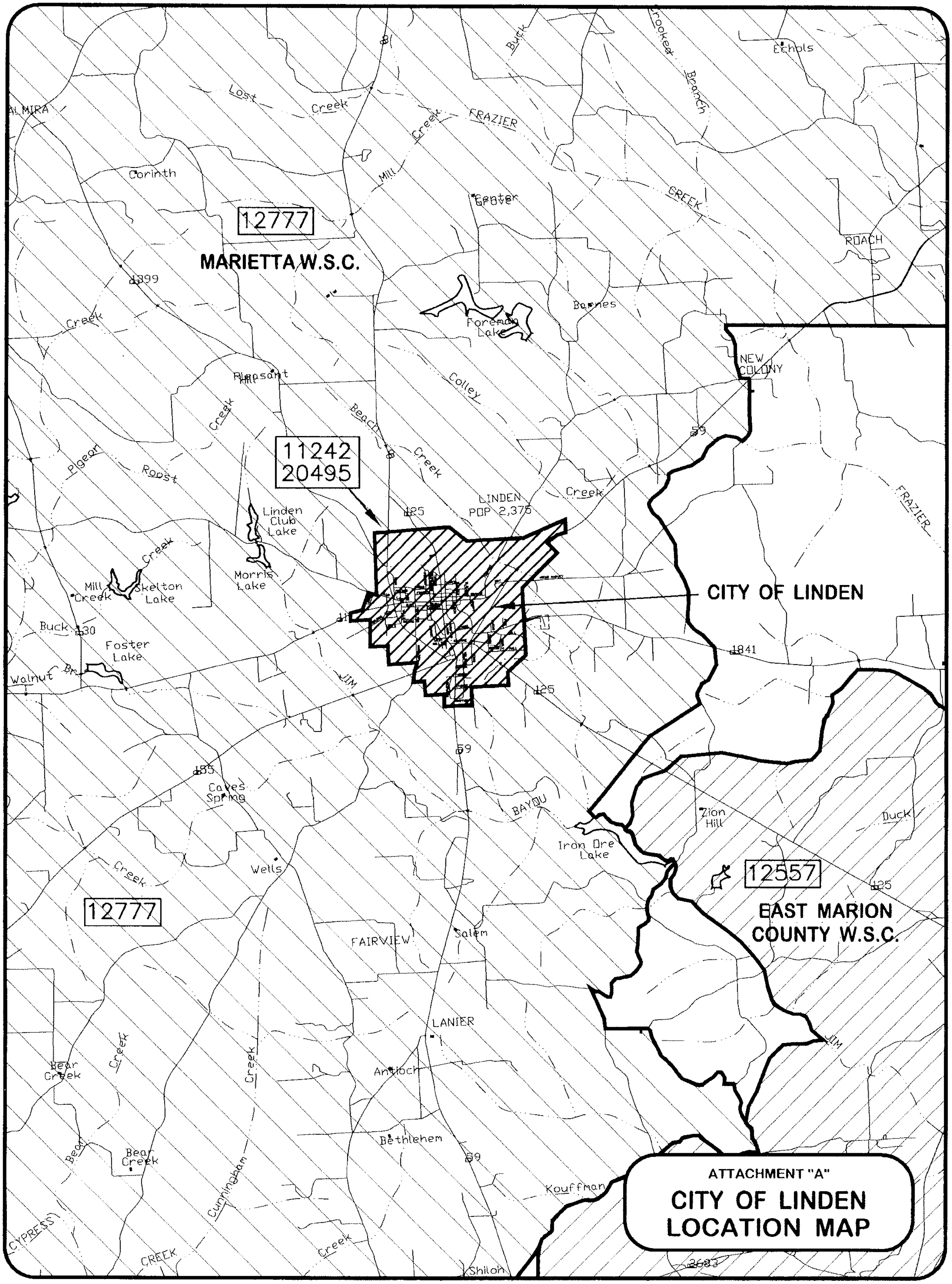
Four alternative strategies were considered to meet the City of Linden's water supply shortages as summarized in the following table. Advanced water conservation was not considered because the per capita use per day did not exceed the 140 gpcpd threshold set by the Water Planning Group. Although the City of Linden has a centralized wastewater collection system, water reuse was not considered because Linden does not have a non-potable water user large enough to warrant the creation of a water reuse plant. Groundwater was considered, as the City of Linden has recently completed a test well which yielded 400 gpm. Surface water was considered, as the Northeast Texas Municipal Water District (NETMWD) has entered into an agreement with the City to provide treated water. A worksheet for the ground water and surface water – purchase water contract are included as Attachments B and C.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**215**	**$ 340,579**	**$ 60,060**	**$ 222**	**Minimal**
Surface Water (purchase contract)	**101**	**$ 1,954,501**	**$ 153,740**	**$ 1,542**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Ground Water (ac-ft/yr)	215	215	215	215	215	215

The recommended strategy for the City of Linden to meet their projected deficit of 92 ac-ft/yr in 2010 and 104 ac-ft/yr in 2060 would be to complete construction of the one additional water well. The recommended supply source will be the Carrizo-Wilcox Aquifer in Cass County. One well with rated capacity of 400 gpm would provide approximately 215 ac-ft/yr. The Carrizo-Wilcox Aquifer in Cass County is projected to have a more than ample supply availability to meet the needs of the City of Linden for the planning period. The City of Linden will continue to maintain an agreement with the NETMWD to purchase treated water in the future should ground water become unreliable or more expensive.



ATTACHMENT "A"

**CITY OF LINDEN
LOCATION MAP**

Attachment B - Groundwater Worksheet
City of Linden
Cass County
City Category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
1	600	400	**215**	$ 334.00	$ 200,400.00	$ 5,010.00	$ 205,410.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
3,000	6	$ 1.67	$ 30,060.00	$ 1,052.10	$ 31,112.10

Total Construction Cost	**$ 236,522.10**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 70,956.63
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 327,479.73**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 19,648.78
4% Rate of Return on Investment of Unspent Funds	$ 6,549.59
Net Interest	**$ 13,099.19**
TOTAL CAPITAL COST	**$ 340,578.92**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 31,537.81

POWER COST

GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
400	150	70%	1	0.06	$ 3,796.04

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 60,059.89**
WUG Total WMS Cost Per Acre-Foot	**$ 221.76**

Attachment C - Surface Water Worksheet
City of Linden
Cass County
City Category

Water Purchase Contract With Northeast Texas Municipal Water District:

Avg. yield (GPD)	Total Yield (AF/YR)	Unit Cost ($ / 1000GAL)
90,000	**100.8**	$ 1.80

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
74,000	10	$ 1.67	$ 1,235,800.00	$ 43,253.00	$ 1,279,053.00

Low Service Pump Station

No. req'd	Total Cost	Land & Easements (1.0%)	
1	$ 170,000.00	$ 1,700.00	$ 171,700.00

Total Construction Cost **$ 1,450,753.00**

Other Capital Costs

ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 435,225.90
INTEREST DURING CONSTRUCTION (3%)	$ 43,522.59
ENVIRONMENTAL (LUMP SUM)	$ 25,000.00
TOTAL CAPITAL COST	**$ 1,954,501.49**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (AF/YR)	92	98	101	106	104	104	100.8
ANNUAL WATER PURCHASE COST (Yield (AF/yr) * 325,851 * $ / 1,000)	$ 53,960.93	$ 57,480.12	$ 59,239.71	$ 62,172.37	$ 60,999.31	$ 60,999.31	$ 59,141.96
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 195,857.73**	**$ 199,376.92**	**$ 201,136.52**	**$ 204,069.18**	**$ 60,999.31**	**$ 60,999.31**	**$ 153,739.83**
UNIT COST ($ / AC-FT / yr)	**$ 2,128.89**	**$ 2,034.46**	**$ 1,991.45**	**$ 1,925.18**	**$ 586.53**	**$ 586.53**	**$ 1,542.17**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

DELTA COUNTY

WUGs:

None

County Other:

Ben Franklin WSC

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF BEN FRANKLIN WATER SUPPLY CORPORATION

Description of Water User Group:

Ben Franklin WSC, which is within the County Other area in Delta County, is a small public water supply located in northern Delta County. The system served 205 people in 2000 and is projected to grow to 279 people by the year 2060. The current source of supply is a single 158 gpm well into the Trinity Aquifer. Ben Franklin WSC provides water to its own customers and also has a supply contract with the Enloe-Lake Creek WSC. Enloe-Lake Creek is planning on entering into surface water supply contract with Delta County MUD and will stop using water from Ben Franklin WSC before 2010. Ben Franklin WSC's well does not meet TCEQ secondary water quality standards and is expected to fail sometime after 2020. BFWSC is projected to have a water supply deficit of 33 ac-ft/yr by 2030 and increasing to a deficit of 36 ac-ft/yr in 2060. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	220	240	259	279	279	279
Projected Water Demand	30	32	33	36	36	36
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	85	85	0	0	0	0
Projected Supply Surplus (+) / Deficit (-)	**55**	**53**	**-33**	**-36**	**-36**	**-36**

Evaluation of Potentially Feasible Water Management Strategies:

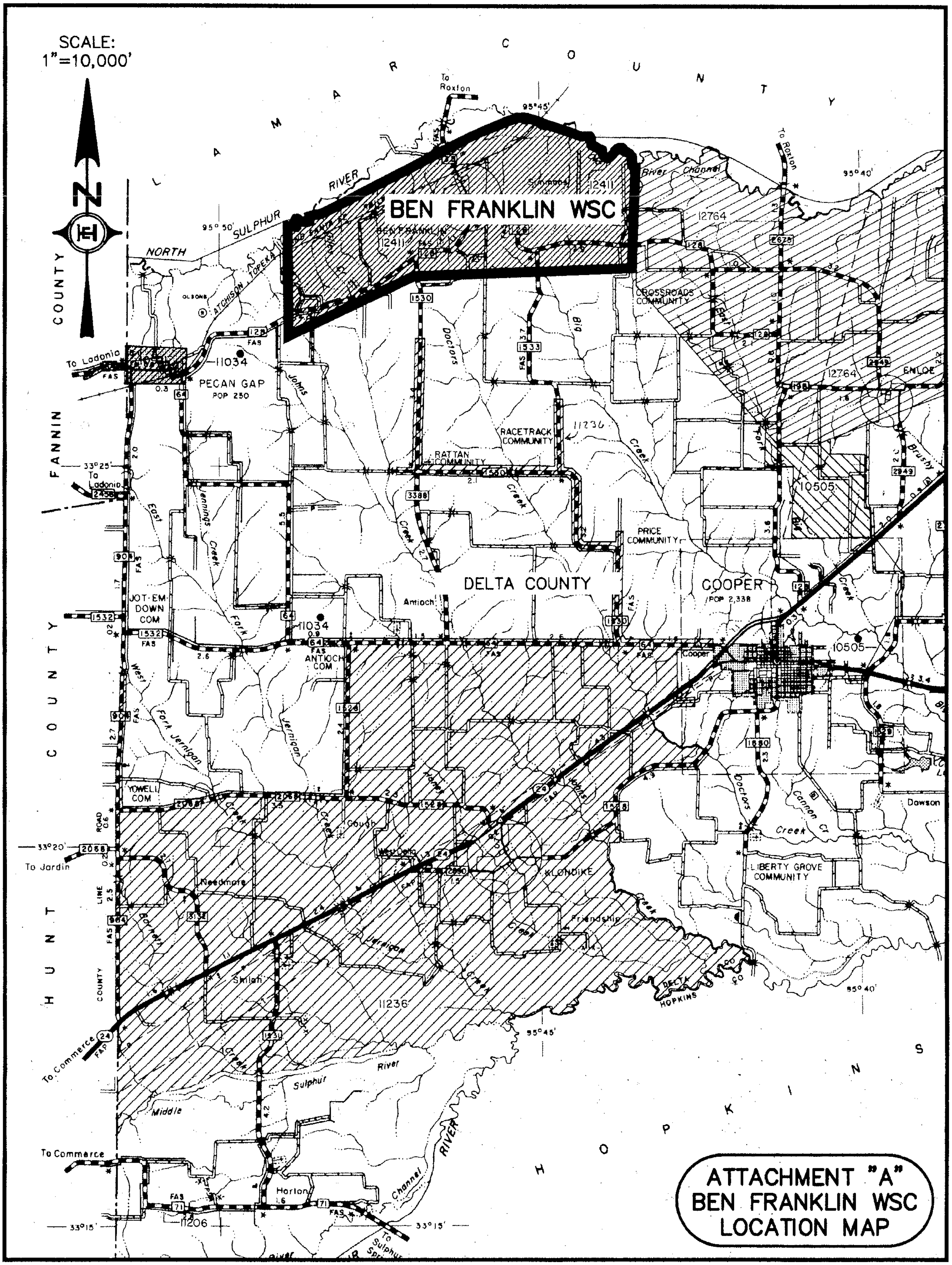
The four alternative strategies considered to meet Ben Franklin's water supply shortages are listed in the table below. Advanced conservation was not selected since per capita use is less than 140 gpcpd. Reuse is not a feasible option because there is no centralized wastewater collection system. Groundwater is not of appropriate quality, as noted above. Operation of a reverse osmosis or similar treatment would not satisfy TCEQ requirements for two wells minimum, and is considered overly complex for a system of this size. Conversion to surface water by contracting or merging with Delta County MUD was the alternative selected for this entity. It should be noted that the system could also be served by surface water from Lamar County Water Supply District. The Delta County MUD strategy appears superior due to lesser construction requirements and lower unit costs.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**36**	**$363,517**	**$28,511**	**$1,213**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)			33	36	36	36

The recommended strategy for Ben Franklin WSC is to enter into a contract for treated surface water with Delta County MUD. The MUD has adequate supply available, and has an expansion project underway which could deliver water to the Ben Franklin area before 2006. Since Delta County MUD already has water available, and since there would be no significant construction, environmental impact would be negligible.



ATTACHMENT "A"
BEN FRANKLIN WSC
LOCATION MAP

Purchased Supply Worksheet
Ben Franklin WSC
Delta County - County Other Category

Attachment B-1, Connect to Delta County MUD

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
32,139	**36.0**	$ 2.00

Pump Station

Number (ea)	Size-MGD	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
1	Rework Existing	$ 73,000.00	$ 73,000.00	$ 730.00	$ 73,730.00

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
13,000	8	$ 1.67	$ 173,680.00	$ 6,078.80	$ 179,758.80

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 253,488.80**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 76,046.64
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 349,535.44**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 20,972.13
4% Rate of Return on Investment of Unspent Funds	$ 6,990.71
Net Interest	**$ 13,981.42**
TOTAL CAPITAL COST	**$ 363,516.86**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	33	36	36	36	24
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ 21,506.17	$ 23,461.27	$ 23,461.27	$23,461.27	$ 15,315.00
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 26,391.32**	**$ 26,391.32**	**$ 47,897.49**	**$ 23,461.27**	**$ 23,461.27**	**$23,461.27**	Average **$ 28,510.66**

UNIT COST
($ / ac-ft / yr) **$ 1,213.22**

Purchased Supply Worksheet
Ben Franklin WSC
Delta County - County Other Category

Attachment B-2, Connect to LCWSD

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
32,139	**36.0**	$ 2.50

Pump Station

Number (ea)	Size-MGD	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	
1	Rework Existing	$ 73,000.00	$ 73,000.00	$ 730.00	$ 73,730.00

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
24,000	8	$ 1.67	$ 320,640.00	$ 11,222.40	$ 331,862.40

Bore Sulpur River

Total Cost	Subtotal
$ 40,000.00	$ 40,000.00

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 445,592.40**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 133,677.72
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 599,270.12**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 35,956.21
4% Rate of Return on Investment of Unspent Fur	$ 11,985.40
Net Interest	**$ 23,970.80**
TOTAL CAPITAL COST	**$ 623,240.92**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	33	36	36	36	24
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ 26,882.71	$ 29,326.59	$ 29,326.59	$ 29,326.59	$ 19,143.75
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 45,247.29**	**$ 45,247.29**	**$ 72,130.00**	**$ 29,326.59**	**$ 29,326.59**	**$ 29,326.59**	**$ 41,767.39**

UNIT COST
($ / ac-ft / yr) **$ 1,777.34**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

FRANKLIN COUNTY

WUGs:

None

County Other:

None

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

GREGG COUNTY

WUGs:

City of Clarksville City
Liberty City WSC
West Gregg SUD

County Other:

Liberty-Danville FWSD No. 2
Starrville-Friendship WSC

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF CLARKSVILLE CITY

Description of Water User Group:

The City of Clarksville City is located along the western end of the Gregg / Upshur county line. The city provides water service to city residents and to residents in Gregg County outside of the city. In 2003, the city served 307 connections in the city and 10 connections in the county. The city population is projected to increase from 903 persons in 2010 to 1,621 persons in 2060 and the county other population is projected to increase from 33 persons in 2010 to 61 persons in 2060. The city relies on water purchased from the City of Gladewater, which utilizes surface water from Lake Gladewater that is owned and operated by the City of Gladewater. The city has a water conservation plan in place, which includes universal metering and education and information. The city does not have a drought contingency plan. The system is bounded on the east by the City the City of White Oak; the south by the Sabine River; the west by the City of Gladewater, and on the north by Union Grove Water Supply Corporation. The City of Gladewater and the City of Clarksville City have mutually agreed to not renew their water purchase contract so Clarksville City must develop a new supply source. The City of Clarksville City and the county residents it serves are projected to have a water supply deficit of 120 ac-ft/yr beginning in 2010 and increasing to a deficit of 217 ac-ft/yr in 2060. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	936	1039	1148	1272	1441	1682
Projected Water Demand	120	134	148	164	186	217
Current Water Supply						
Projected Supply Surplus(+)/Deficit(-)	**-120**	**-134**	**-148**	**-164**	**-186**	**-217**

Evaluation of Potentially Feasible Water Management Strategies:

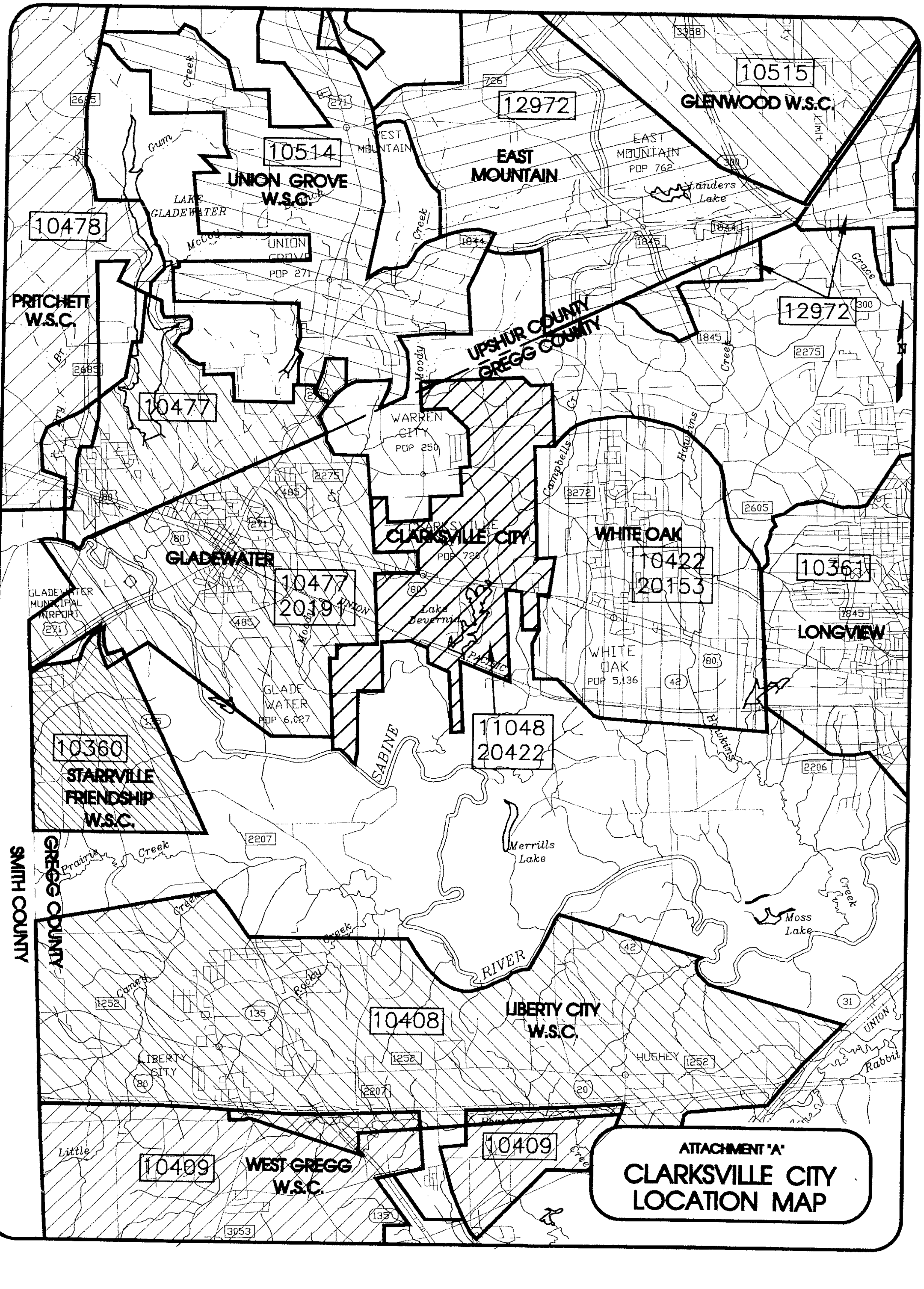
Four alternative strategies were considered to meet the City of Clarksville City water supply shortages as summarized in the following table. Advanced water conservation was not considered as a strategy because the per capita use per day is less than the 140 gallons per capita per day threshold set by the water planning group and they have no supply at all with the expiration of the contract with Gladewater. Water reuse was not considered because there are no potential users of reclaimed water in Clarksville City. Surface water was considered, however, the closest surface water source is from Lake Gladewater and mutually agreeable terms for renewal of their contract could not be reached. A groundwater worksheet is included as Attachment B.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualize d Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**217**	**$1,518,443**	**$ 150,043**	**$ 743**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	162	162	162	242	242	242

The City of Clarksville City has applied for funding to construct a well field in the Carrizo-Wilcox Aquifer in Gregg County with an expected yield of 162 ac-ft/yr. The recommended strategy that is cost effective and reliable for the city to meet their projected needs is to develop this well field by constructing two 150-gpm water wells and constructing water treatment facilities as necessary to attain water quality and quantity required to meet current demands and projected demands to 2040. An additional 150 gpm well will need to be added prior to 2040 to add 80 ac-ft/yr. The recommended supply source, Carrizo-Wilcox or Queen City Aquifers, Sabine Basin, in Gregg or Upshur Counties, both have ample supply to provide for the future needs of the City of Clarksville City.



ATTACHMENT "A"

CLARKSVILLE CITY LOCATION MAP

Attachment B - Groundwater worksheet
City of Clarksville City
Gregg County
WUG

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
3	850	150.2	**242**	$ 400.00	$ 1,020,000.00	$ 25,500.00	$ 1,045,500.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
6,000	6	$ 1.67	$ 60,120.00	$ 2,104.20	$ 62,224.20

Total Construction Cost	**$ 1,107,724.20**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 332,317.26
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL BORROWED FUNDS	**$ 1,460,041.46**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 87,602.49
4% Rate of Return on Investment of Unspent Funds	$ 29,200.83
Net Interest	**$ 58,401.66**
TOTAL CAPITAL COST	**$ 1,518,443.12**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 35,527.35

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	150.2	150	70%	3	0.06	$ 4,276.24

TOTAL ANNUALIZED COST (O & M Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 150,042.56**
WUG Total WMS Cost Per Acre-Foot ($ / AC-FT / yr)	**$ 742.78**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF LIBERTY CITY WSC

Description of Water User Group:

Liberty City WSC provides water service in the rural southwestern portion of Gregg County and eastern Smith County. In 2003, the WSC served 1,574 connections. The population is projected to increase from 4,526 persons in 2010 to 8,485 persons in 2060. The City of Liberty City is served by the WSC. The WSC is included in the City and the County Other WUG for Gregg County and County Other WUG for Smith County. The system relies on six wells with a total rated capacity of 925 GPM, or 492 ac-ft/yr. The system currently has a leak detection program for water conservation. The system is bounded on the north by Prairie Creek and the Sabine River; the east by SH 31; the south by Liberty-Danville FWSD #1 and West Gregg WSC; and on the west by the Starville WSC. LCWSC does not have a water conservation plan or a drought management plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	4526	5077	5647	6305	7201	8485
Projected Water Demand	625	701	779	870	994	1170
Current Water Supply	492	492	492	492	492	492
Projected Supply Surplus(+)/Deficit(-)	**-133**	**-209**	**-287**	**-378**	**-502**	**-678**

Evaluation of Potentially Feasible Water Management Strategies:

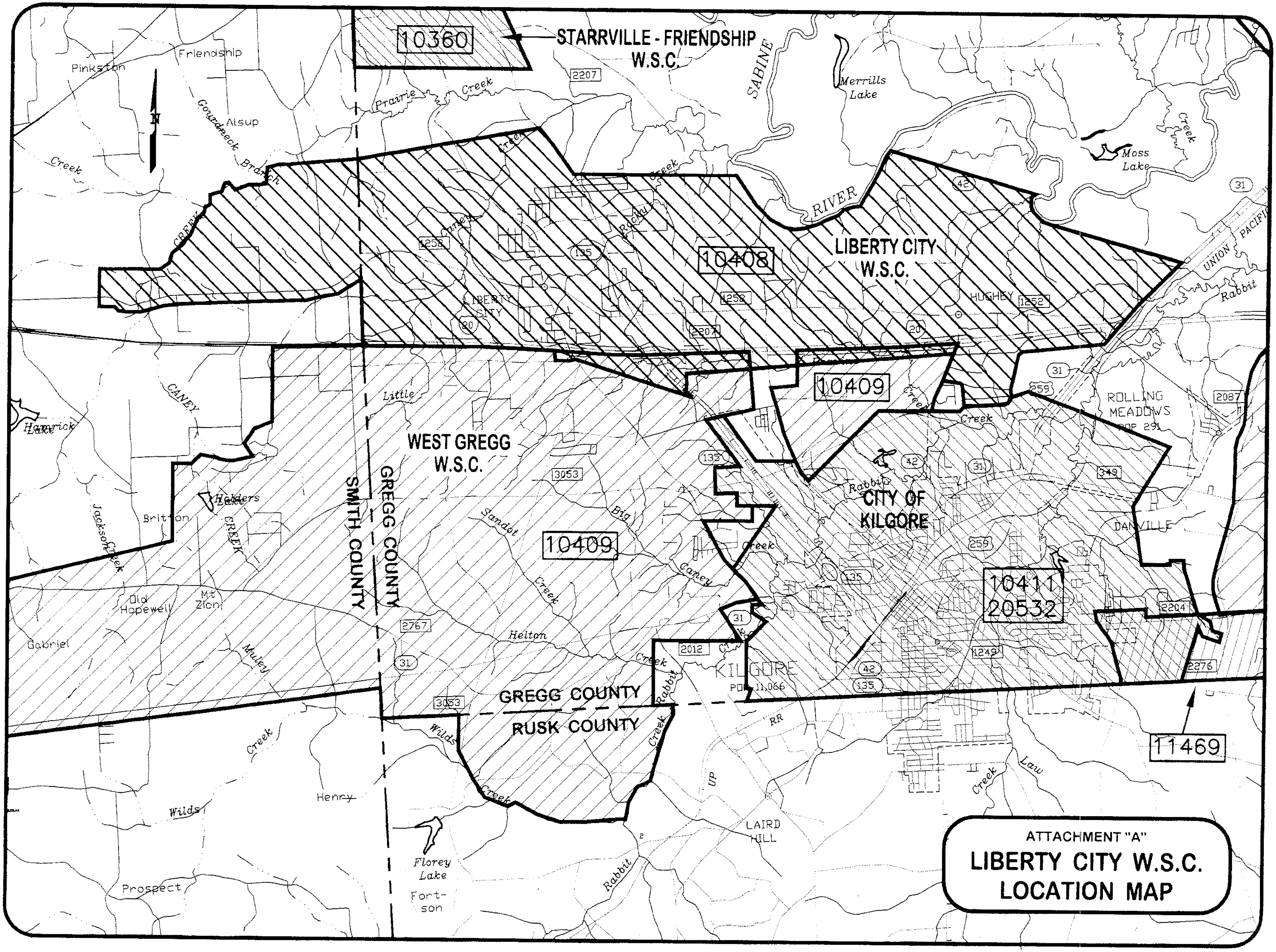
Five alternative strategies were considered to meet the Liberty City WSC water supply shortages as summarized in the following table. Advanced water conservation was eliminated for LCWSC because after further review the per capita use per day of 128 gpcpd was below the 140 gpcpd threshold set by the water planning group. Water reuse was not considered because the Liberty City area does not have a centralized wastewater collection system. Surface water alternatives were omitted since no supply source is within close proximity to the area, and surface water treatment is not economically feasible for a system of this size. LCWSC has purchased water from the City of Kilgore in the recent past, so a purchase agreement alternative was considered. A worksheet for the groundwater alternative is included as Attachment B. A worksheet for the water purchase alternative is included as Attachment C.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater (wells)	**753**	**$ 2,096,569**	**$ 271,451**	**$ 627**	**Minimal**
Groundwater (purchased)	**678**	**$ 367,8140**	**$ 309,490**	**$ 645**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr) (wells)	188	282	376	470	564	752

Liberty City WSC is currently completing plans to construct an additional water well (April, 2003). The recommended strategy for LCWSC to meet their projected deficits would be to complete construction of this water well, and construct seven additional water wells similar to their largest existing well. The recommended supply source for the wells would be the Carrizo-Wilcox Aquifer in Gregg County, which is projected to have an adequate supply availability for Liberty City WSC. A total of eight additional wells with a rated capacity of 175 GPM each would provide approximately 752 additional ac-ft/yr. The wells should be constructed in the decades when the deficits are projected to occur. Due to the high unit cost of purchasing water from the City of Kilgore, the purchase agreement option is not recommended unless better terms can be negotiated with the City of Kilgore.



ATTACHMENT "A"

LIBERTY CITY W.S.C.
LOCATION MAP

Attachment B - Groundwater Worksheet
Liberty City WSC (includes City of Liberty City)
Gregg County
City and County Other Category

Water Well Development:
CAPITAL COST

Construction
Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
8	500	175	**753**	$ 334.00	$ 1,336,000.00	$ 33,400.00	$ 1,369,400.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
16,000	6	$ 1.67	$ 160,320.00	$ 5,611.20	$ 165,931.20

Total Construction Cost	**$ 1,535,331.20**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 460,599.36
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 2,015,931.56**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 120,955.89
4% Rate of Return on Investment of Unspent Funds	$ 40,318.63
Net Interest	**$ 80,637.26**
TOTAL CAPITAL COST	**$ 2,096,568.82**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 110,382.35

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	175	100	70%	8	0.06	$ 8,857.43

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 271,450.68**
WUG Total WMS Cost Per Acre-Foot	**$ 626.91**

Attachment C - Purchase Groundwater Worksheet
Liberty City WSC (includes City of Liberty City)
Gregg and Smith Counties
City and County Other Category

Water Purchase Contract With City of Kilgore:

Yield (gpm)	Total Yield (AF/YR)	Unit Cost ($ / 1000GAL)
	678.0	$ 1.60

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
35,000	12	$ 2.00	$ 840,000.00	$ 29,400.00	$ 869,400.00

Total Construction Cost	**$ 869,400.00**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 260,820.00
INTEREST DURING CONSTRUCTION (3%)	$ 26,082.00
ENVIRONMENTAL (LUMP SUM)	$ -
TOTAL CAPITAL COST	**$ 1,156,302.00**
ANNUAL WATER PURCHASE COST (Yield (AF/yr) * 325,851 * $ / 1,000)	$ 353,483.16
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 437,430.69**
UNIT COST ($ / AC-FT / yr)	**$ 645.18**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF WEST GREGG SUD

Description of Water User Group:

West Gregg SUD provides water service in the rural southwestern corner of Gregg County, a portion of eastern Smith County, and a small portion of Rusk County. Approximately 3% of the system is outside of Region D. In 2003, the system served approximately 1,287 connections. The population is projected to increase from 3,376 persons in 2010 to 6,382 persons in 2060. The SUD is included in the WUGs for Gregg, Smith, and Rusk Counties. The system relies on seven wells with a total rated capacity of 910 gpm, or 489 ac-ft/yr. Approximately 19 ac-ft of this capacity is allocated to users outside of Region D. The system currently has a water conservation plan and a leak detection program. The system is bounded on the north by Liberty City WSC; the east by Liberty-Danville FWSD #1; the south by the City of Kilgore, and the west by the Browning community in Smith County. WG SUD has a water conservation plan but does not have a drought management plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	3376	3799	4233	4718	5409	6382
Projected Water Demand	442	489	545	608	697	822
Current Water Supply	489	489	489	489	489	489
Projected Supply Surplus(+)/Deficit(-)	+47	0	**-56**	**-119**	**-208**	**-333**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the West Gregg SUD water supply shortages as summarized in the following table. Advanced water conservation was not considered because the per capita use per day of 120 gpcpd is less than the 140 gpcpd threshold set by the water planning group. Water reuse was not considered because the West Gregg service area does not have a centralized wastewater collection system. Surface water alternatives were omitted since no supply source is within close proximity to the area, and surface water treatment is not economically feasible for a system of this size. A ten-year master plan was recently completed for this system and the supply improvements specified in that plan were considered and listed on the groundwater worksheet. The worksheet for the groundwater alternative is included as Attachment B.

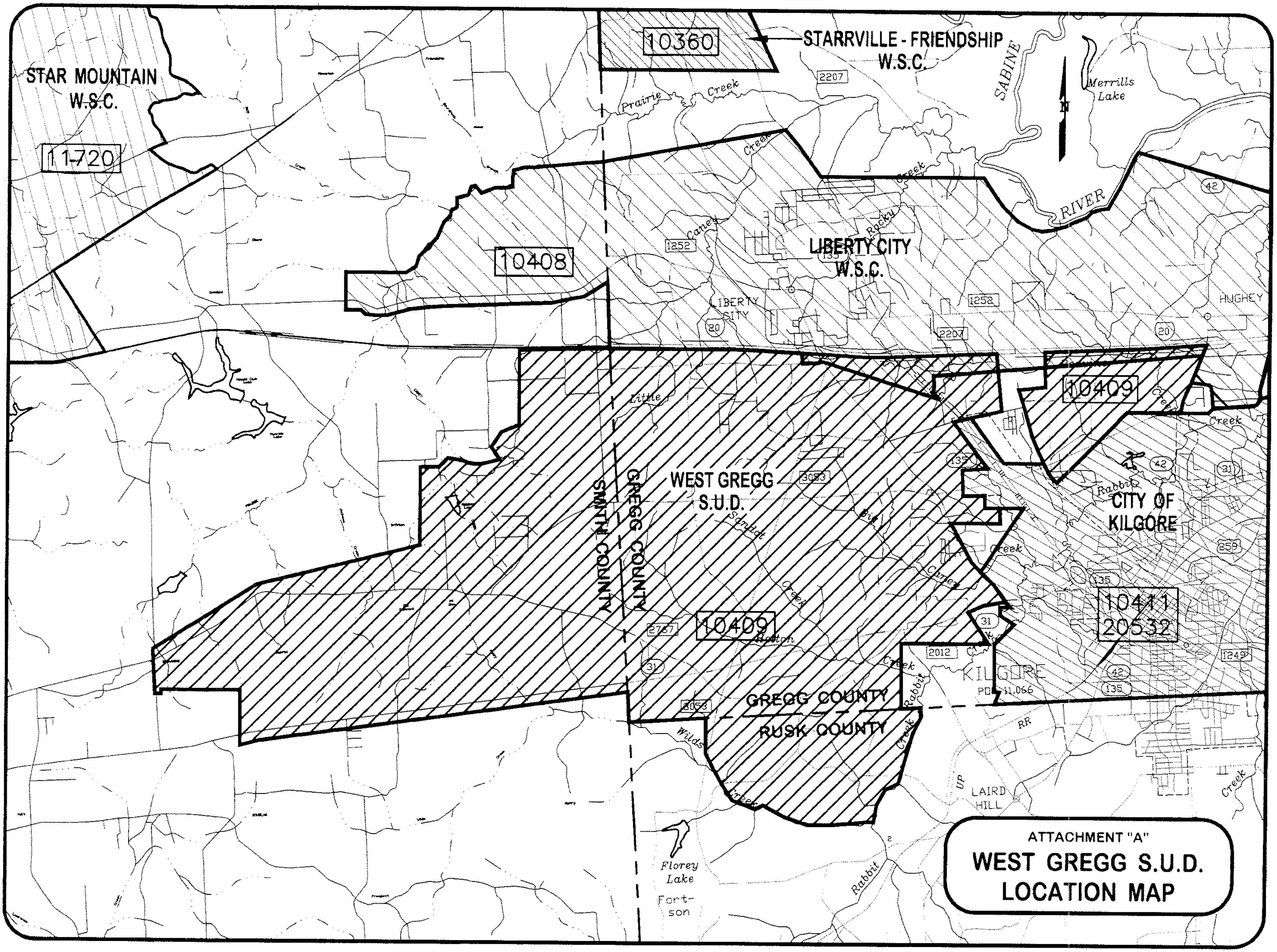
Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**350**	**$ 1,502,847**	**$ 166,524**	**$ 320**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr) (wells)			70	140	210	350

The recommended strategy for West Gregg SUD to meet their projected deficits would be to construct five additional water wells similar to their existing wells. The recommended supply source for the wells would be the Carrizo-Wilcox Aquifer in Gregg County, which is projected to have an ample supply availability for WG SUD. A total of five additional wells at 130 gpm each would provide approximately 350 additional ac-ft/yr. The wells should be constructed in the decades when the deficits are projected to occur.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.



ATTACHMENT "A"
WEST GREGG S.U.D.
LOCATION MAP

Attachment B - Groundwater Worksheet
West Gregg SUD
Gregg, Smith, and Rusk County
WUG

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
5	600	130	**350**	$ 334.00	$1,002,000.00	$ 25,050.00	$ 1,027,050.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
10,000	4	$ 1.67	$ 66,800.00	$ 2,338.00	$ 69,138.00

Total Construction Cost	**$ 1,096,188.00**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 328,856.40
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 1,445,045.40**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 86,702.72
4% Rate of Return on Investment of Unspent Funds	$ 28,900.91
Net Interest	**$ 57,801.82**
TOTAL CAPITAL COST	**$ 1,502,847.22**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 51,248.95

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	130	150	70%	5	0.06	$ 6,168.57

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 166,524.23**
WUG Total WMS Cost Per Acre-Foot	**$ 320.37**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF LIBERTY-DANVILLE FWSD 2

Description of Water User Group:

Liberty-Danville FWSD 2 provides water service in the rural southwestern portion of Gregg County east of the City of Kilgore. In 2003, the FWSD served 215 connections. The population is projected to increase from 618 persons in 2010 to 1,158 persons in 2060. The Liberty-Danville FWSD 2 is included in the County Other WUG for Gregg County. The system has a water purchase contract with the City of Kilgore for 36 MG/yr or 111 ac-ft/yr. The system is bounded on the north by I-20 and the Sabine River; the east by Elderville WSC; the south by Cross Roads WSC; and on the west by the City of Kilgore. LCWSC does not have a water conservation plan or a drought management plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	618	693	771	861	983	1158
Projected Water Demand	84	92	102	112	128	151
Current Water Supply	111	111	111	111	111	111
Projected Supply Surplus(+)/Deficit(-)	+27	+19	+9	**-1**	**-17**	**-40**

Evaluation of Potentially Feasible Water Management Strategies:

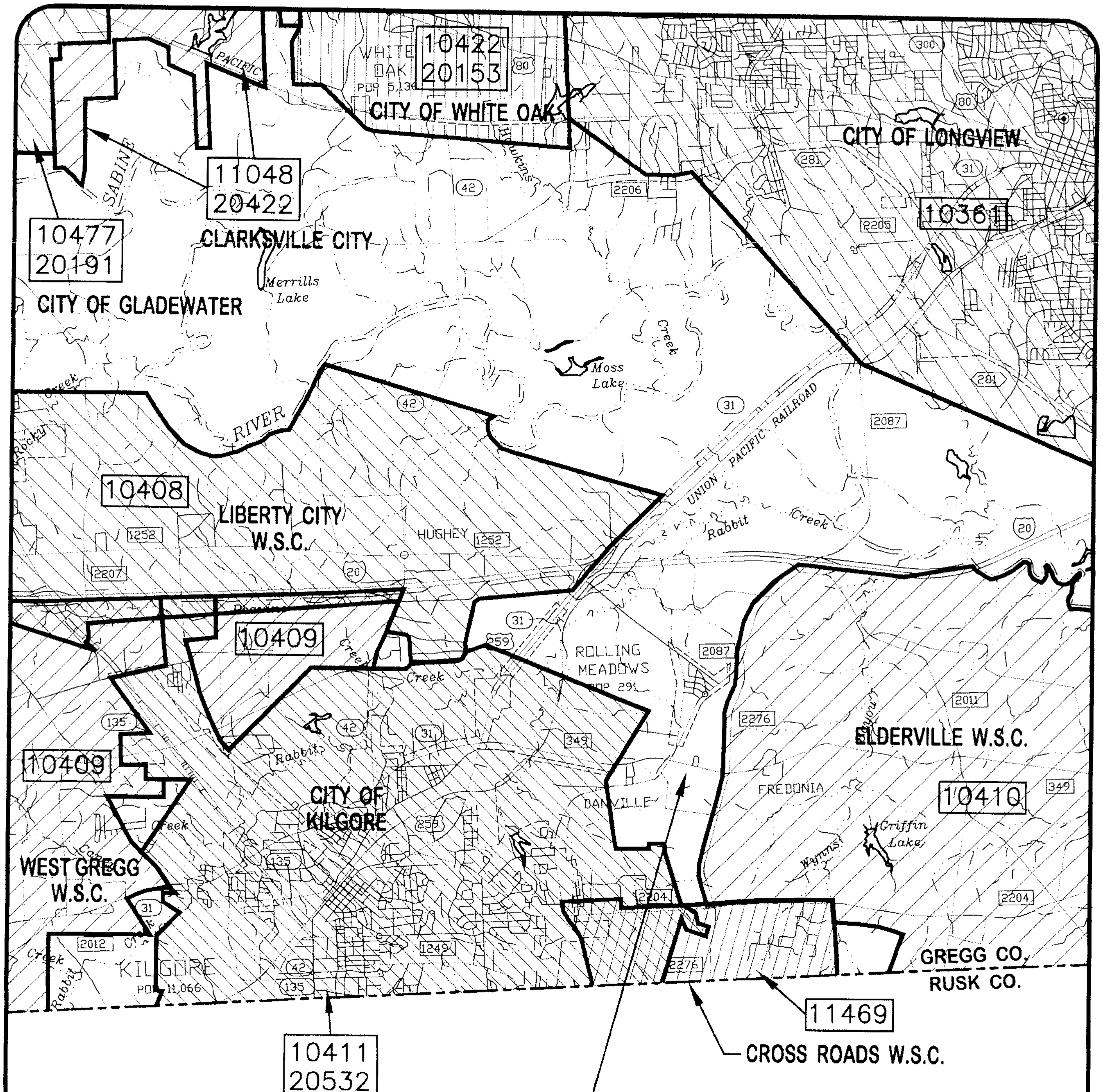
Four alternative strategies were considered to meet the Liberty-Danville FWSD 2 water supply shortages as summarized in the following table. Advanced water conservation was eliminated for LDFWSD 2 because the per capita use per day of 104 gpcpd was below the 140 gpcpd threshold set by the water planning group. Water reuse was not considered because the Liberty-Danville FWSD 2 area does not have a centralized wastewater collection system. Surface water alternatives were omitted since no supply source is within close proximity to the area, and surface water treatment is not economically feasible for a system of this size. Liberty-Danville FWSD 2 currently purchases treated water from the City of Kilgore, so a purchase agreement alternative was considered. A worksheet for the groundwater alternative is included as Attachment B. A worksheet for the water purchase alternative is included as Attachment C.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater (wells)	**40**	**$ 550,789**	**$ 46,612**	**$ 660**	**Minimal**
Surface Water (purchased)	**40**	**$ 0**	**$ 32,585**	**$ 815**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)				1	17	40

The recommended strategy for Liberty-Danville FWSD 2 to meet their projected deficits would be to extend and increase their water purchase contract with the City of Kilgore. The recommended supply source for the water purchase would be the Sabine Run of the River (ROR) in Gregg County, which is projected to have an adequate supply availability for Liberty-Danville FWSD 2. The water purchase contract should be amended as deficits arise yielding 40 ac-ft/yr by 2060.



ATTACHMENT "A"
LIBERTY - DANVILLE F.W.S.D. #2
LOCATION MAP

Attachment B - Groundwater Worksheet
Liberty-Danville FWSD 2
Gregg County
County Other Category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
1	500	75	**40**	$ 334.00	$ 167,000.00	$ 4,175.00	$ 171,175.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,000	4	$ 1.67	$ 13,360.00	$ 467.60	$ 13,827.60

Pump station w/storage tank

Const. Cost	Land & Easements -3.50%	Subtotal
$ 200,000.00	$ 7,000.00	$ 207,000.00

Total Construction Cost	**$ 392,002.60**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 117,600.78
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 529,604.38**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 31,776.26
4% Rate of Return on Investment of Unspent Funds	$ 10,592.09
Net Interest	**$ 21,184.18**
TOTAL CAPITAL COST	**$ 550,788.56**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 5,913.34

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	75	150	70%	1	0.06	$ 711.76

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 46,612.35**
WUG Total WMS Cost Per Acre-Foot	**$ 660.06**

Attachment C - Purchase Surface Water Worksheet
Liberty-Danville FWSD 2
Gregg County
County Other Category

Water Purchase Contract With City of Kilgore:

Yield (gpm)	Total Yield (AF/YR)	Unit Cost ($ / 1000GAL)
	40.0	$ 2.50

ANNUAL WATER PURCHASE COST (Yield (AF/yr) * 325,851 * $ / 1,000)	$ 32,585.10
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 32,585.10**
UNIT COST ($ / AC-FT / yr)	**$ 814.63**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF STARRVILLE-FRIENDSHIP WSC

Description of Water User Group:

Starrville-Friendship WSC provides water service in western Gregg County and northeastern Smith County. The SFWSC service area is bounded on the west by Star Mountain WSC, on the north and east by the Sabine River, and on the south by Liberty City WSC. In 2003, the WSC served 530 connections. The projected population is 1,247 in the year 2010 and is projected to be 2,386 in the year 2060. Starrville-Friendship WSC is included in the County Other water user group for Gregg and Smith Counties. The system is served by three wells from the Carrizo-Wilcox Aquifer with a total pumping capacity of 385 gpm, or 207 ac-ft/yr on an average annual basis. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	1247	1409	1574	1750	2018	2386
Projected Water Demand	170	189	207	226	261	308
Current Water Supply	207	207	207	207	207	207
Projected Supply Surplus (+) / Deficit (-)	+37	+18	0	**-19**	**-54**	**-101**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the Starrville-Friendship WSC water supply shortages as summarized in the table below. Advanced water conservation was not considered because the per capita use per day did not exceed the 140 gpcpd threshold set the water planning group. Water reuse was omitted from consideration because the WSC does not have a centralized sewerage collection system. Surface water alternatives were omitted since surface water treatment for an entity of this size is not practical. A ground water worksheet is included as Attachment B.

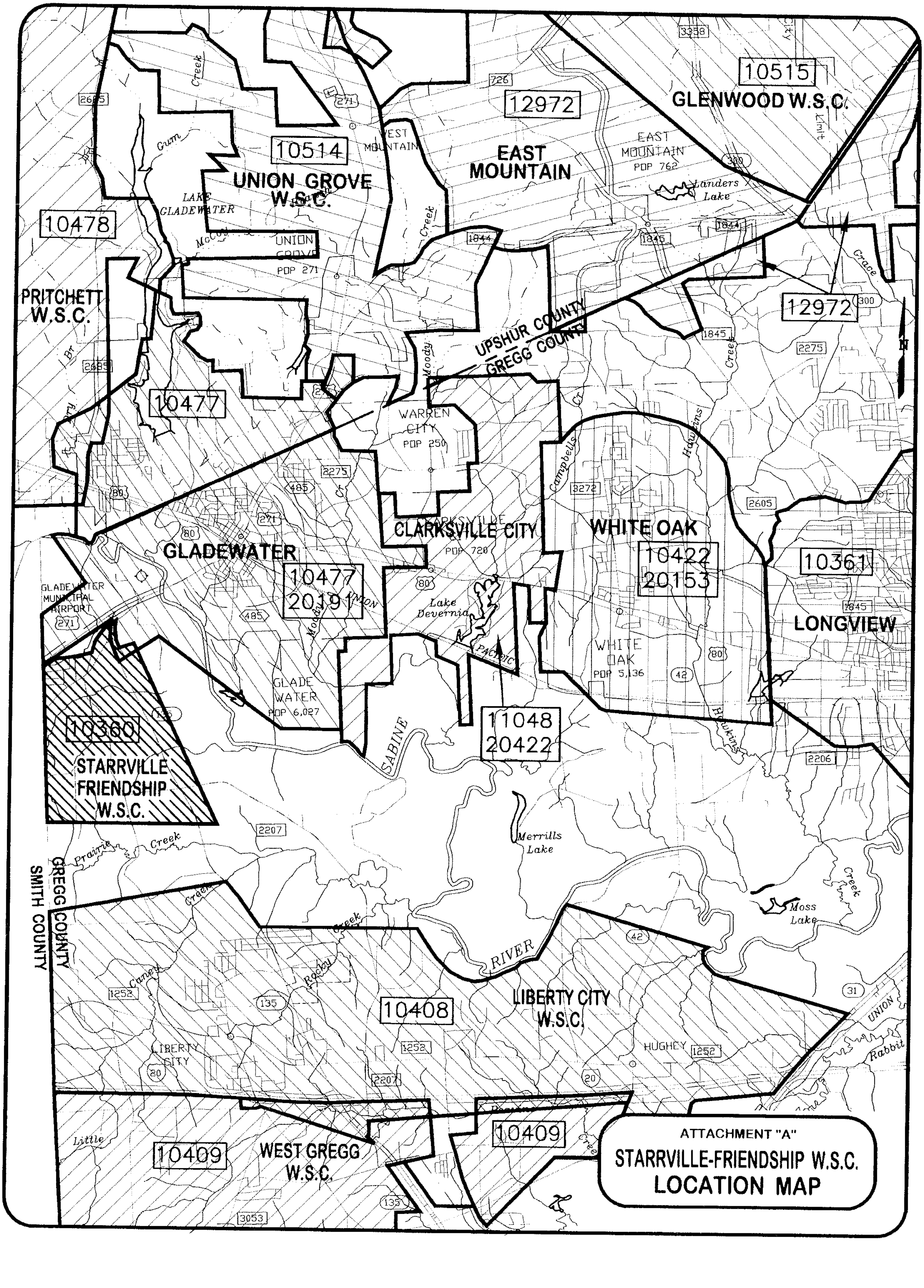
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**108**	**$ 316,158**	**$ 39,355**	**$ 259**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)				108	108	108

The recommended strategy for Starrville-Friendship WSC to meet their projected deficit of 19 ac-ft in the year 2040 and 101 ac-ft in the year 2060 would be to construct one additional water well in the Carrizo-Wilcox Aquifer. One well with a total rated capacity of 200 gpm would provide approximately 108 ac-ft/yr. The well will need to be constructed by the year 2040. The supply source will be the Carrizo-Wilcox Aquifer in the Sabine Basin, Smith County. The aquifer has an adequate supply to meet the projected needs of SF WSC.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendation previously discussed should be disregarded and a re-evaluation completed.


10515
GLENWOOD W.S.C.
12972
EAST MOUNTAIN
10514
UNION GROVE W.S.C.
10478
PRITCHETT W.S.C.
UPSHUR COUNTY
GREGG COUNTY
10477
WARREN CITY POP 250
12972
GLADEWATER
10477
20191
CLARKSVILLE CITY
WHITE OAK
10422
20153
10361
LONGVIEW
10360
STARRVILLE FRIENDSHIP W.S.C.
11048
20422
GREGG COUNTY
SMITH COUNTY
10408
LIBERTY CITY W.S.C.
10409
WEST GREGG W.S.C.
10409
ATTACHMENT "A"
STARRVILLE-FRIENDSHIP W.S.C.
LOCATION MAP

Attachment B - Groundwater Worksheet
Starrville-Friendship WSC
Gregg and Smith County
County Other Category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
1	600	200	**108**	$ 334.00	$ 200,400.00	$ 5,010.00	$ 205,410.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,000	6	$ 1.67	$ 20,040.00	$ 701.40	$ 20,741.40

Total Construction Cost	**$ 226,151.40**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 67,845.42
ENVIRONMENTAL (LUMP SUM)	$ 10,000.00
Total Borrowed Funds	**$ 303,997.82**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 18,239.87
4% Rate of Return on Investment of Unspent Funds	$ 6,079.96
Net Interest	**$ 12,159.91**
TOTAL CAPITAL COST	**$ 316,157.73**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 15,768.91

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	200	50	70%	1	0.06	$ 632.67

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 39,354.63**
WUG Total WMS Cost Per Acre-Foot	**$ 259.23**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

HARRISON COUNTY

WUGs:

City of Waskom

County Other:

Blocker-Crossroads WSC

Caddo Lake WSC

Harleton WSC

Leigh WSC

City of Scottsville

Talley WSC

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF THE CITY OF WASKOM

Description of Water User Group:

The City of Waskom is located in southeastern Harrison County and serves the incorporated city limits and an area immediately north, east, and south of the City of Waskom. In 2003, the system had 957 residential connections. The population is projected to increase from 2,872 persons in 2010 to 4,240 persons in 2060. The City is included in the County Other WUG for Harrison County. The system's current water supply consists of eight water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 735 GPM, or 395 ac-ft/yr. The system is bounded on the east, south, and west by the Waskom Rural Water WSC #1. The City does not have a water conservation plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	2872	3228	3485	3679	3907	4240
Projected Water Demand	370	416	449	474	503	546
Current Water Supply	395	395	395	395	395	395
Projected Supply Surplus (+)/Deficit(-)	+25	**-21**	**-54**	**-79**	**-108**	**-151**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the City of Waskom water supply shortages as summarized in the following table. Advanced conservation was not considered because the per capita use per day was below the 140 gpcpd threshold set by the planning group. Water reuse was not considered because the City does not have a demand for non-potable water. Surface water alternatives were omitted since there is not a supply source within close proximity to the City and surface water treatment is not economically feasible for a system of this size. A groundwater worksheet is included as Attachment B.

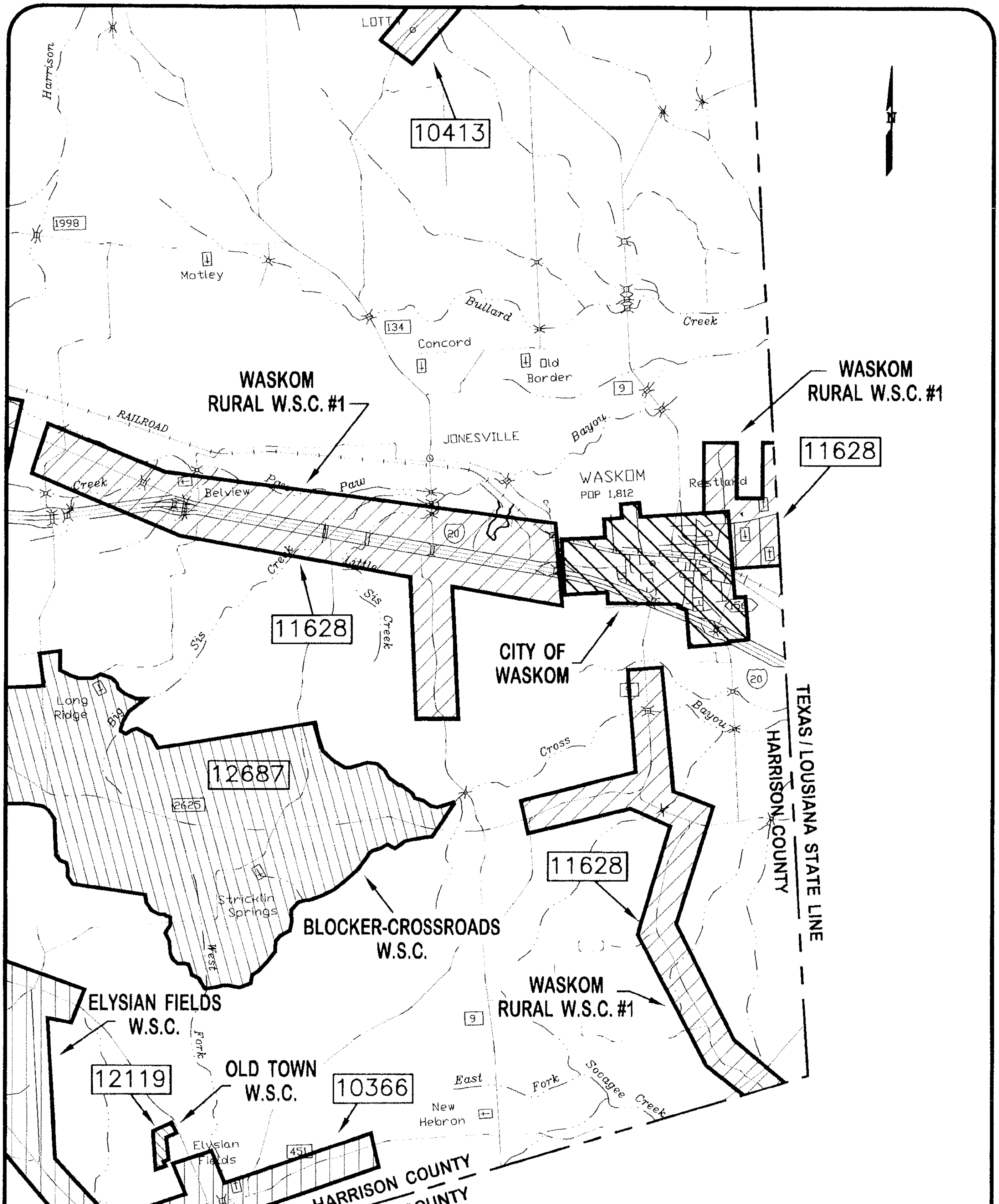
Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**176**	**$ 455,466**	**$ 62,041**	**$ 854**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)		44	88	88	132	176

The recommended strategy for the City of Waskom to meet their projected deficit of 21 ac-ft/yr in 2020 and 151 ac-ft/yr in 2060 would be to construct one additional water well similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Carrizo-Wilcox Aquifer in Harrison County. Four wells with rated capacity of 82 gpm each would provide approximately 44 acre-feet each or 176 ac-ft/yr. The Carrizo-Wilcox Aquifer in Harrison County is projected to have a more than ample supply availability to meet the needs of the City of Waskom for the planning period.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.



ATTACHMENT "A"

CITY OF WASKOM
LOCATION MAP

Attachment B - Groundwater Worksheet
City of Waskom
Harrison County
City and County Other Categories

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
4	200	82	**176**	$ 334.00	$ 267,200.00	$ 6,680.00	$ 273,880.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
8,000	4	$ 1.67	$ 53,440.00	$ 1,870.40	$ 55,310.40

Total Construction Cost	**$ 329,190.40**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 98,757.12
ENVIRONMENTAL (LUMP SUM)	$ 10,000.00
Total Borrowed Funds	**$ 437,948.52**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 26,276.91
4% Rate of Return on Investment of Unspent Funds	$ 8,758.97
Net Interest	**$ 17,517.94**
TOTAL CAPITAL COST	**$ 455,466.46**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 25,861.01

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	82	150	70%	4	0.06	$ 3,112.75

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 62,040.63**
WUG Total WMS Cost Per Acre-Foot	**$ 853.77**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF BLOCKER-CROSSROADS WSC

Description of Water User Group:

Blocker-Crossroads WSC is located in southeastern Harrison County and serves an area east of US Hwy. 59 and south of Interstate Highway 20. In 2003 the system had 383 members. The population is projected to increase from 835 persons in 2010 to 1,225 persons in 2060. The BCWSC is included in the County Other water user group for Harrison County. The system's current water supply consists of two water wells that provide water from the Carrizo-Wilcox Aquifer. The total rated capacity of these two wells is 56 GPM, which equates to 30 ac-ft/yr on an annual average basis. The system is bounded on the west by Gill WSC, on the north by the City of Scottsville, on the east by Waskom Rural WSC, and on the south by Elysian Fields WSC. BCWSC does not have a water conservation plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	835	936	1010	1065	1130	1225
Projected Water Demand	108	121	130	137	146	158
Current Water Supply	30	30	30	30	30	30
Projected Supply Surplus(+)/Deficit(-)	**-78**	**-91**	**-100**	**-107**	**-116**	**-128**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the BCWSC water supply shortages as summarized in the following table. Advanced conservation was omitted from consideration because the per capita use per day was below the 140 gpcpd threshold set by the water planning group. Water reuse was omitted from consideration because the BCWSC does not have a centralized sewerage collection system. Surface water alternatives were omitted since there is not a supply source within close proximity to the BCWSC and surface water treatment is not economically feasible for a system of this size. A groundwater worksheet is included as Attachment B.

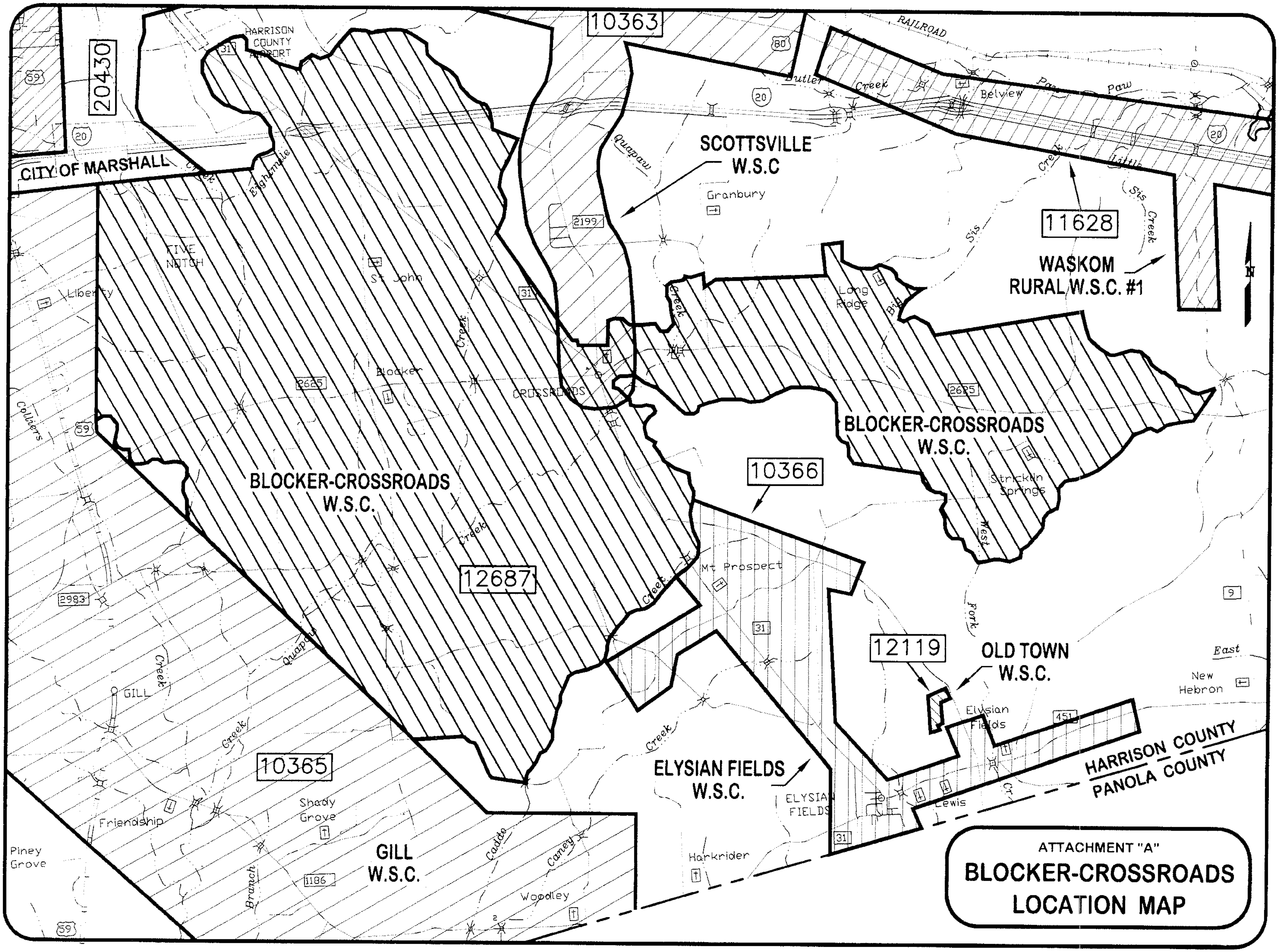
Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**129**	**$ 483,057**	**$ 57,029**	**$ 306**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	86	86	129	129	129	129

The recommended strategy for the Blocker-Crossroads WSC to meet their projected deficit of 78 acre-feet in the year 2010 and 128 acre-feet in the year 2060 would be to construct two additional water wells prior to 2010 and one additional well prior to 2030. The three wells will need to average 80 gpm each. The recommended supply source woiuld be the Carrizo-Wilcox Aquifer in Harrison County. A well with rated capacity of 80 gpm would provide approximately 43 acre-feet on an annualized basis. The Carrizo-Wilcox Aquifer in Harrison County is projected to have a more than ample supply availability to meet the needs of BCWSC for the planning period. BCWSC has already applied for funding for two additional wells.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.


ATTACHMENT "A"
BLOCKER-CROSSROADS
LOCATION MAP
BLOCKER-CROSSROADS
W.S.C.
12687
BLOCKER-CROSSROADS
W.S.C.
SCOTTSVILLE
W.S.C
10363
WASKOM
RURAL W.S.C. #1
11628
10366
OLD TOWN
W.S.C.
12119
ELYSIAN FIELDS
W.S.C.
GILL
W.S.C.
10365
20430
CITY OF MARSHALL
HARRISON COUNTY
PANOLA COUNTY
HARRISON
COUNTY
AIRPORT
RAILROAD
Belview
Granbury
Long
Ridge
Strickln
Springs
St John
Blocker
CROSSROADS
FIVE
NOTCH
Liberty
Colliers
Mt Prospect
Elysian
Fields
ELYSIAN
FIELDS
New
Hebron
Lewis
Harkrider
GILL
Friendship
Shady
Grove
Piney
Grove
Woodley
Quapaw
Eightmile
Butler
Paw Paw
Sis Creek
Little
West
Fork
East
Caddo
Caney
Branch
Big
N

Attachment B - Groundwater Worksheet
Blocker-Crossroads WSC
Harrison County
County Other Category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
3	300	80	**129**	$ 334.00	$ 300,600.00	$ 7,515.00	$ 308,115.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
6,000	4	$ 1.67	$ 40,080.00	$ 1,402.80	$ 41,482.80

Total Construction Cost	**$ 349,597.80**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 104,879.34
ENVIRONMENTAL (LUMP SUM)	$ 10,000.00
Total Borrowed Funds	**$ 464,478.14**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 27,868.69
4% Rate of Return on Investment of Unspent Funds	$ 9,289.56
Net Interest	**$ 18,579.13**
TOTAL CAPITAL COST	**$ 483,057.27**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 18,922.69

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	80	200	70%	3	0.06	$ 3,036.83

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 57,029.48**
WUG Total WMS Cost Per Acre-Foot	**$ 306.05**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CADDO LAKE WSC

Description of Water User Group:

Caddo Lake WSC is located in northeastern Harrison County and serves the community of Uncertain east of Karnack and west of Caddo Lake. In 2003, the system had 427 members. The population is projected to increase from 1,032 persons in 2010 to 1,515 persons in 2060. The CLWSC is included in the County Other water user group for Harrison County. The system's current water supply consists of four water wells that provide water from the Carrizo-Wilcox Aquifer. The total rated capacity of these four wells is 267 gpm, which equates to 143 ac-ft/year on an annual average basis. The system is bounded on the west by Karnack WSC, on the north by the Big Cypress Bayou, on the east by Caddo Lake, and on the south by the Longhorn Army Ammunition Plant. The CLWSC does not have a water conservation plan or a drought management plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	1032	1158	1249	1318	1398	1515
Projected Water Demand	133	149	161	170	180	195
Current Water Supply	143	143	143	143	143	143
Projected Supply Surplus(+)/Deficit(-)	+10	**-6**	**-19**	**-27**	**-37**	**-52**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the CLWSC water supply shortages as summarized in the following table. Advanced conservation was omitted from consideration because the per capita use per day was below the 140 gpcpd threshold set by the water planning group. Water reuse was omitted from consideration because the CLWSC does not have a centralized sewerage collection system. Surface water alternatives were omitted since there is not a supply source within close proximity to the CLWSC and surface water treatment is not economically feasible for a system of this size. A groundwater worksheet is included as Attachment B.

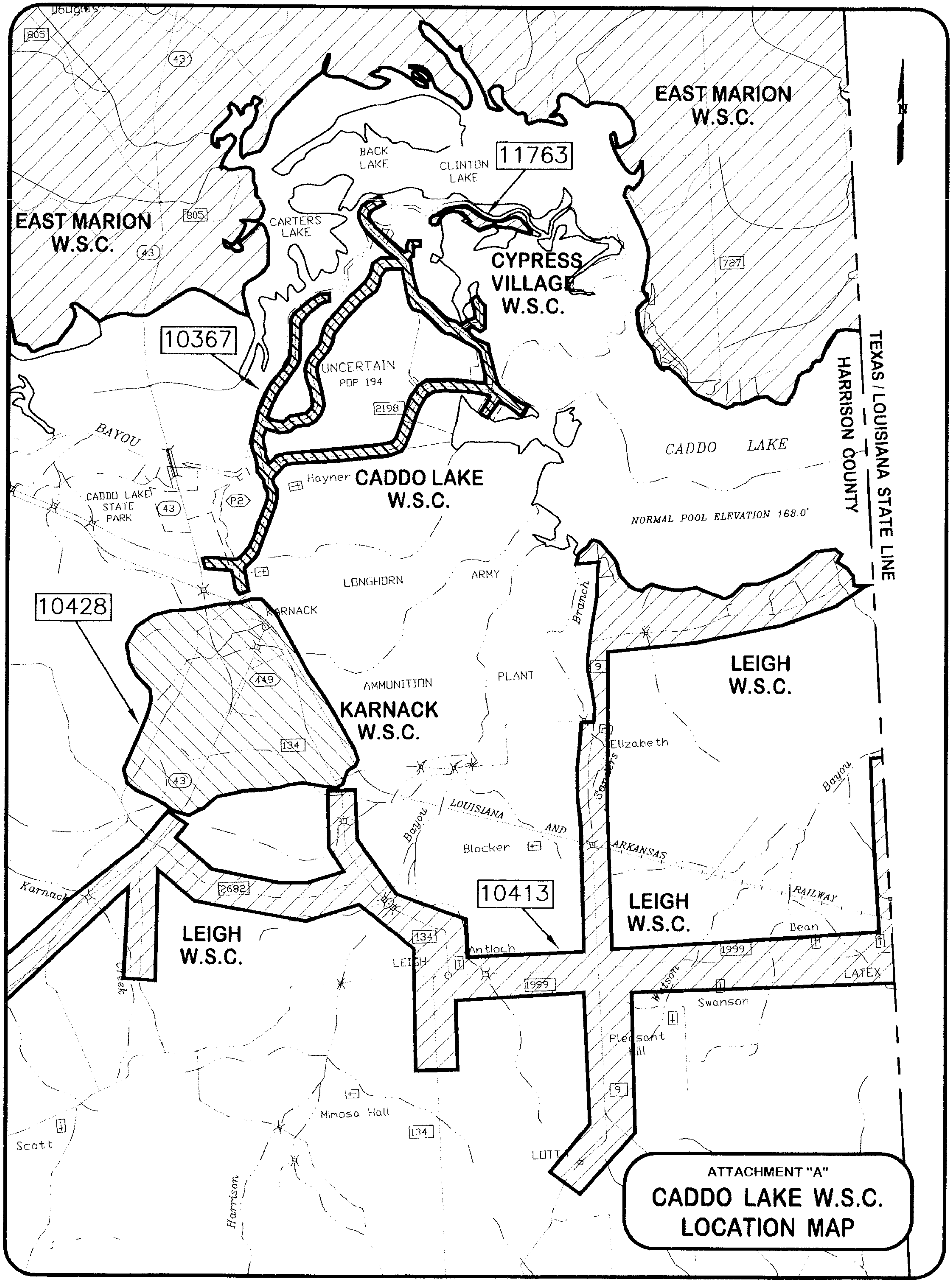
Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**86**	**$ 227,734**	**$ 30,667**	**$ 260**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)		43	43	43	43	86

The recommended strategy for the Caddo Lake WSC to meet their projected deficit of 6 acre-feet in the year 2020 and 52 acre-feet in the year 2060 would be to construct two additional water wells similar to their existing wells just prior to each decade as the deficits occur. The recommended supply source will be the Carrizo-Wilcox Aquifer in Harrison County. One well with rated capacity of 80 gpm would provide approximately 43 acre-feet on an annualized basis and 86 acre-feet total. The Carrizo-Wilcox Aquifer in Harrison County is projected to have a more than ample supply availability to meet the needs of CLWSC for the planning period.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.


EAST MARION
W.S.C.
EAST MARION
W.S.C.
BACK
LAKE
CLINTON
LAKE
11763
CARTERS
LAKE
CYPRESS
VILLAGE
W.S.C.
10367
UNCERTAIN
POP 194
2198
BAYOU
CADDO LAKE
TEXAS / LOUISIANA STATE LINE
HARRISON COUNTY
Hayner
CADDO LAKE
W.S.C.
CADDO LAKE
STATE
PARK
NORMAL POOL ELEVATION 168.0'
LONGHORN
ARMY
10428
KARNACK
Branch
LEIGH
W.S.C.
449
AMMUNITION
PLANT
KARNACK
W.S.C.
Elizabeth
134
43
Bayou
LOUISIANA
AND
ARKANSAS
RAILWAY
Blocker
Karnack
2682
10413
LEIGH
W.S.C.
LEIGH
W.S.C.
Antioch
Dean
LEIGH
1999
LATEX
Swanson
Pleasant
Hill
Mimosa Hall
Scott
LOTTA
Harrison
ATTACHMENT "A"
CADDO LAKE W.S.C.
LOCATION MAP

Attachment B - Groundwater Worksheet
Caddo Lake WSC
Harrison County
County Other Category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
2	200	80	**86**	$ 334.00	$ 133,600.00	$ 3,340.00	$ 136,940.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
4,000	4	$ 1.67	$ 26,720.00	$ 935.20	$ 27,655.20

Total Construction Cost	**$ 164,595.20**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 49,378.56
ENVIRONMENTAL (LUMP SUM)	$ 5,000.00
Total Borrowed Funds	**$ 218,974.76**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 13,138.49
4% Rate of Return on Investment of Unspent Funds	$ 4,379.50
Net Interest	**$ 8,758.99**
TOTAL CAPITAL COST	**$ 227,733.75**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 12,615.13

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	80	150	70%	2	0.06	$ 1,518.42

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 30,667.01**
WUG Total WMS Cost Per Acre-Foot	**$ 260.37**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF HARLETON WSC

Description of Water User Group:

Harleton WSC is located in northwestern Harrison County and southwestern Marion County and serves an area around the communities of Harleton, Smyrna, Lake Deerwood, and Jackson. The system completed an expansion in 2005 giving the system 1,130 members with 87% in Harrison County and 13% in Marion County. The population is projected to increase from 2,749 persons in 2010 to 3,902 persons in 2060. The HWSC is included in the County Other WUG for Harrison and Marion Counties. The system's current water supply consists of five water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 557 gpm, or 299 ac-ft/yr. The system is bounded on the west by Diana WSC, on the north by Lake O' the Pines, on the south by Little Cypress Creek, and Karnack WSC and Caddo Lake WSC to the east. HWSC does not have a water conservation plan or a drought management plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	2749	3052	3268	3430	3622	3902
Projected Water Demand	354	393	421	442	467	503
Current Water Supply	263	263	263	263	263	263
Projected Supply Surplus(+)/Deficit(-)	**-91**	**-130**	**-158**	**-179**	**-204**	**-240**

Evaluation of Potentially Feasible Water Management Strategies:

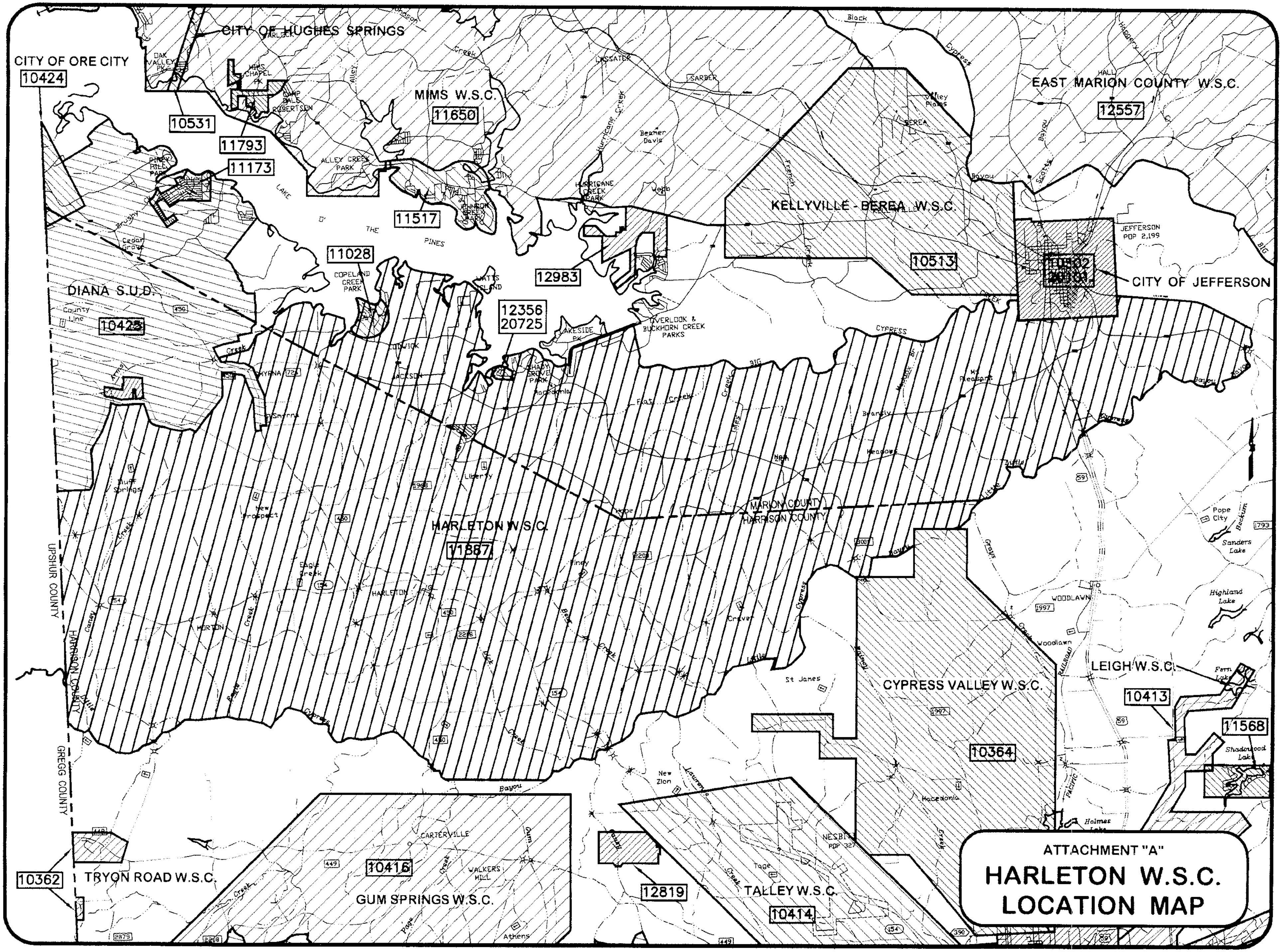
Four alternative strategies were considered to meet the HWSC water supply shortages as summarized in the following table. Advanced conservation was not considered because the per capita use per day was below the 140 gpcpd threshold set by the water planning group. Water reuse was not considered because the HWSC does not have a centralized sewerage collection system. One surface water alternative was completed that included extending their water purchase contract the Northeast Texas Municipal Water District near Jefferson. The groundwater alternative was eliminated because HWSC has had difficulty in the past developing acceptable wells due to poor quality groundwater. The HWSC recently completed a project to expand their service area and connect to the NETMWD near Jefferson. The worksheet for the surface water alternative is included as Attachment B.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater					
Surface Water (purchased)	**240**	**$ 0**	**$ 179,898**	**$ 749**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	91	130	158	179	204	240

The recommended strategy for the Harleton WSC to meet their projected deficit of 91 ac-ft/yr in 2010 and 240 ac-ft/yr in 2060 would be to extend and increase their surface water contract with the Northeast Texas Municipal Water District. The recommended supply source will be the Lake O' The Pines in Marion County. NETMWD would add approximately 91 ac-ft/yr by 2010 and 204 ac-ft/yr by 2060 to the HWSC. The Lake O' The Pines in Marion County is projected to have a more than ample supply availability to meet the needs of HWSC for the planning period.


CITY OF ORE CITY
10424
CITY OF HUGHES SPRINGS
10531
11793
11173
MIMS W.S.C.
11650
11517
11028
12983
12356
20725
KELLYVILLE - BEREA W.S.C.
10513
EAST MARION COUNTY W.S.C.
12557
CITY OF JEFFERSON
JEFFERSON
POP 2,199
DIANA S.U.D.
HARLETON W.S.C.
11887
MARION COUNTY
HARRISON COUNTY
UPSHUR COUNTY
GREGG COUNTY
CYPRESS VALLEY W.S.C.
10364
LEIGH W.S.C.
10413
11568
TALLEY W.S.C.
10414
12819
GUM SPRINGS W.S.C.
10416
TRYON ROAD W.S.C.
10362
ATTACHMENT "A"
HARLETON W.S.C.
LOCATION MAP

Attachment B - Surface Water Worksheet
Harleton WSC
Marion and Harrison County
County Other Category

Water Purchase Contract With Northeast Texas Municipal Water District:

Avg. yield (GPD)	Total yield (GPD)	Total Yield (AF/YR)	Unit Cost ($ / 1000GAL)
214,300	214,300	**240.0**	$ 1.85

OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 35,191.91
Water Purchase Cost (Average Yield (AF/yr) * 325,851 * $ 1.85/ 1,000)	$ 144,706.08
TOTAL ANNUALIZED COST (O & M Cost + Water Purchase Cost)	**$ 179,897.98**
UNIT COST ($ / AC-FT / yr)	**$ 749.43**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF LEIGH WSC

Description of Water User Group:

Leigh WSC is located in northeastern Harrison County and serves an area south of Karnack and Caddo Lake, east of the City of Marshall, and North of the City of Waskom. In 2003, the system had 824 members. The population is projected to increase from 1,032 persons in 2010 to 1,515 persons in 2060. The CLWSC is included in the County Other water user group for Harrison County. The system's current water supply consists of three water wells that provide water from the Carrizo-Wilcox Aquifer and a contract with the City of Marshall for 184 ac-ft/year. The total rated capacity of the three wells is 290 gpm, which equates to 156 ac-ft/year on an annual average basis. The system is bounded on the west by the City of Marshall, on the north by Karnack WSC and Caddo Lake, on the east by Caddo Lake, and on the south by the City of Waskom. The LWSC does not have a water conservation plan or a drought management plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	2139	2398	2161	2729	2895	3139
Projected Water Demand	256	288	310	327	347	376
Current Water Supply	340	340	340	340	340	340
Projected Supply Surplus(+)/Deficit(-)	+84	+52	+30	+13	-7	**-36**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the LWSC water supply shortages as summarized in the following table. Advanced conservation was omitted from consideration because the per capita use per day was below the 140 gpcpd threshold set by the water planning group. Water reuse was omitted because the LWSC does not have a centralized sewerage collection system. Surface water alternatives were omitted since there is not a supply source within close proximity to the LWSC and surface water treatment is not economically feasible for a system of this size. Leigh WSC currently purchases treated surface water from the City of Marshall so increasing that contract was considered. A groundwater worksheet is included as Attachment B and a purchase surface water worksheet is included as Attachment C.

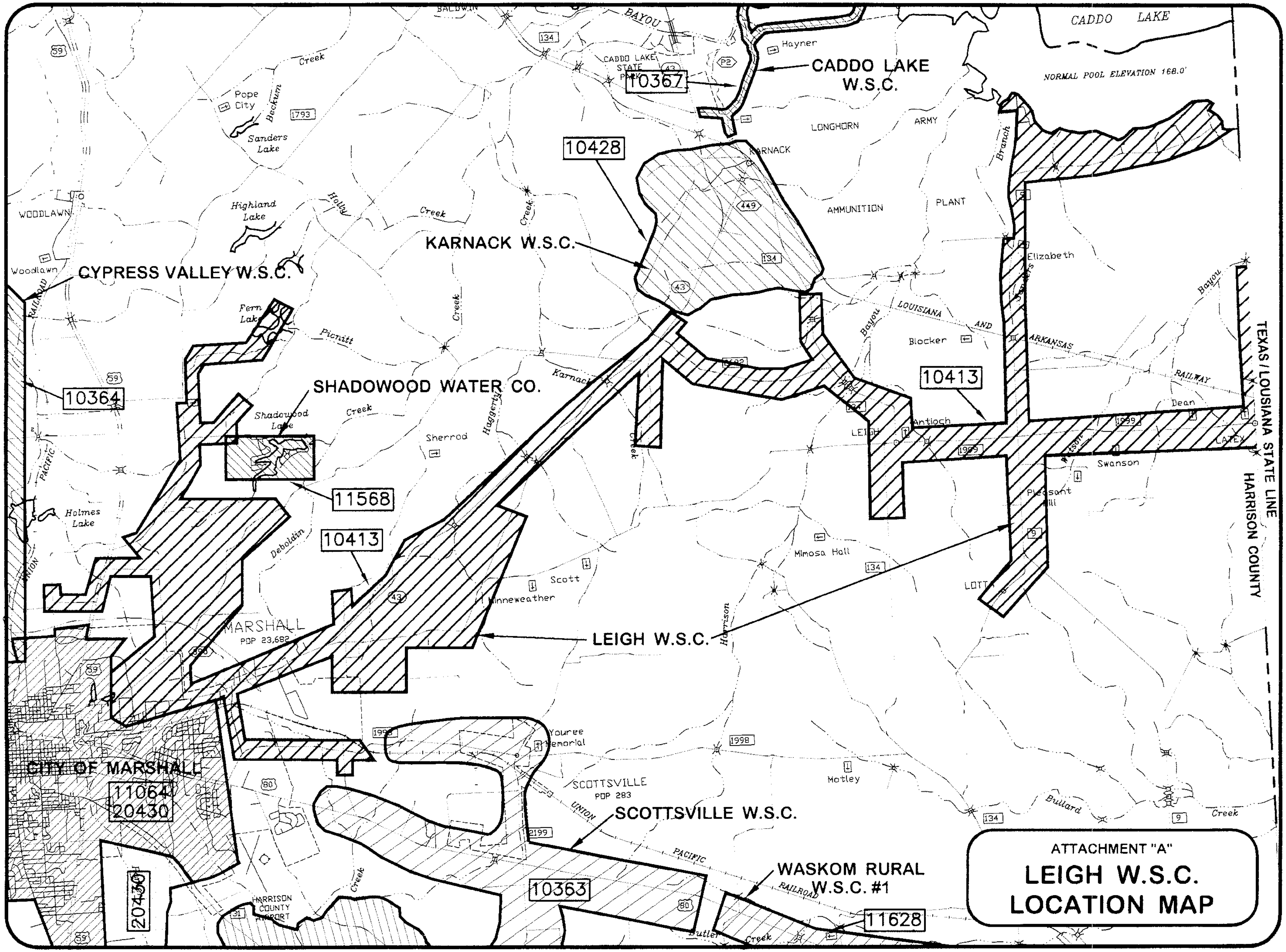
Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**43**	**$ 139,610**	**$ 17,202**	**$ 282**	**Minimal**
Surface Water (purchased)	**43**	**$ 0**	**$ 54,225**	**$ 1,261**	

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)					43	43

The recommended strategy for the Leigh WSC to meet their projected deficit of 7 acre-feet in the year 2050 and 36 acre-feet in the year 2060 would be to construct one additional water well similar to their existing wells just prior to 2050. The recommended supply source will be the Carrizo-Wilcox aquifer in Harrison County. One well with rated capacity of 80 gpm would provide approximately 43 acre-feet on an annualized basis. The Carrizo-Wilcox Aquifer in Harrison County is projected to have a more than ample supply availability to meet the needs of LWSC for the planning period.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.



ATTACHMENT "A"

LEIGH W.S.C. LOCATION MAP

Attachment B - Groundwater Worksheet
Leigh WSC
Harrison County
County Other Category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
1	250	80	**43**	$ 334.00	$ 83,500.00	$ 2,087.50	$ 85,587.50

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,000	4	$ 1.67	$ 13,360.00	$ 467.60	$ 13,827.60

Total Construction Cost	**$ 99,415.10**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 29,824.53
ENVIRONMENTAL (LUMP SUM)	$ 5,000.00
Total Borrowed Funds	**$ 134,240.63**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 8,054.44
4% Rate of Return on Investment of Unspent Funds	$ 2,684.81
Net Interest	**$ 5,369.63**
TOTAL CAPITAL COST	**$ 139,610.26**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 6,307.56

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	80	150	70%	1	0.06	$ 759.21

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 17,202.48**
WUG Total WMS Cost Per Acre-Foot	**$ 282.10**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF THE CITY OF SCOTTSVILLE

Description of Water User Group:

The City of Scottsville is located in southeastern Harrison County and serves the incorporated city limits and an area immediately north, east, and south of the City of Scottsville. In 2003 the system had 277 residential connections. The population is projected to increase from 720 persons in 2010 to 1,057 persons in 2060. The City is included in the County Other WUG for Harrison County. The system's current water supply consists of two water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 240 gpm, or 129 ac-ft/yr. The system is bounded on the east by Waskom Rural Water WSC #1, on the south by Blocker-Crossroads WSC, on the west by the City of Marshall, and on the north by Leigh WSC. The City does not have a water conservation plan or a drought contingency plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	720	808	871	919	975	1057
Projected Water Demand	93	104	112	118	126	136
Current Water Supply	129	129	129	129	129	129
Projected Supply Surplus (+)/Deficit(-)	+36	+25	+17	+11	+3	-7

Evaluation of Potentially Feasible Water Management Strategies:

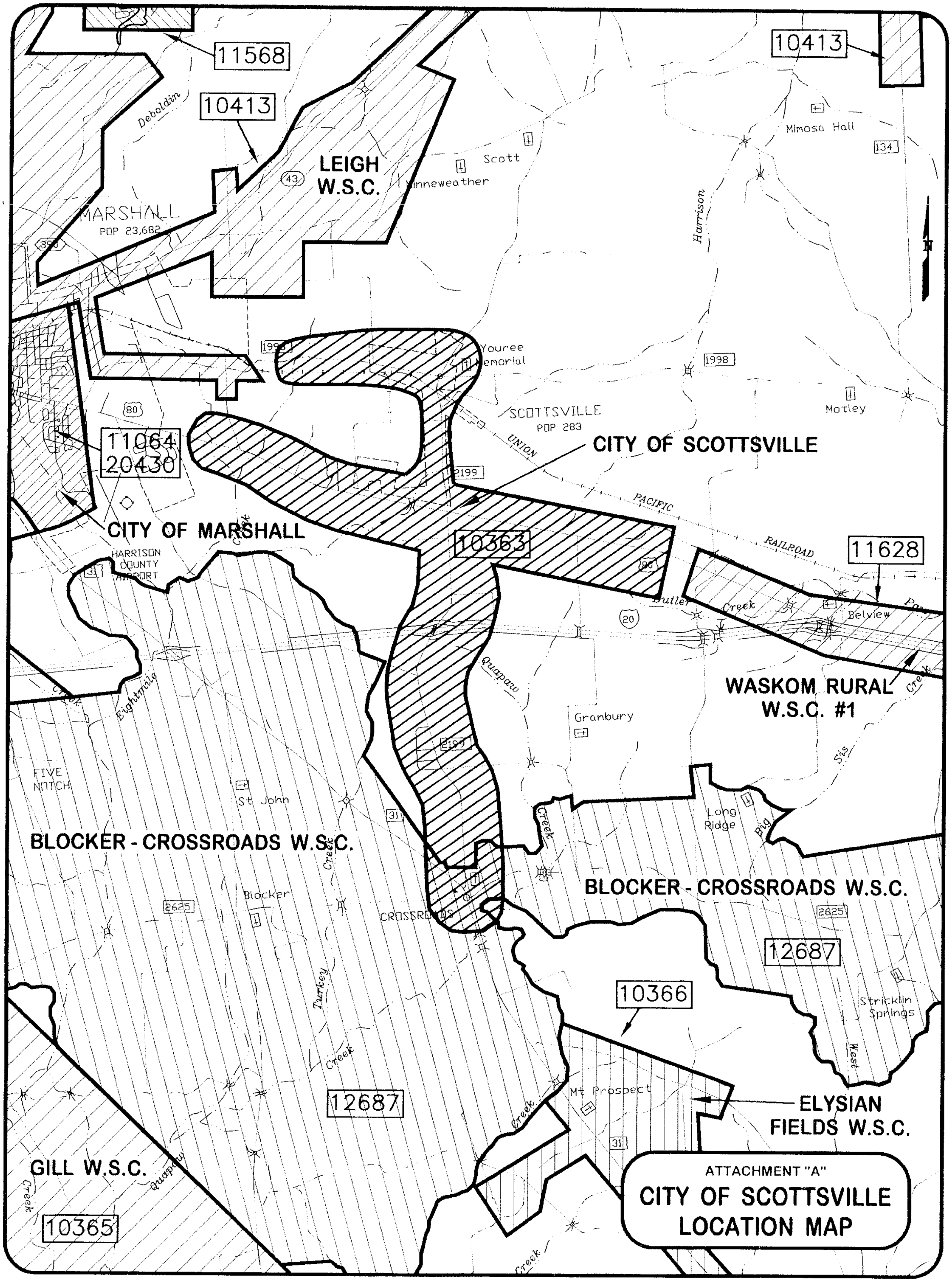
Four alternative strategies were considered to meet the City of Scottsville water supply shortages as summarized in the following table. Advanced conservation was considered because the per capita use per day of 155 is above the 140 gpcpd threshold set by the planning group. Water reuse was not considered because the City does not have a demand for non-potable water. Surface water alternatives were omitted since there is not a supply source within close proximity to the City and surface water treatment is not economically feasible for a system of this size. A groundwater worksheet is included as Attachment B. A worksheet for advanced water conservation is included as Attachment C.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation	7	$ 44,876		$ 685	Minimal
Water Reuse					
Groundwater	65	$ 167,953	$ 23,173	$ 265	Minimal
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)						65

The recommended strategy for the City of Scottville to meet their projected deficit of 7 ac-ft/yr in 2060 would be construct one additional water well prior to 2060. The recommended supply source will be the Carrizo-Wilcox Aquifer in Harrison County. A well with rated capacity of 120 gpm would provide approximately 65 acre-feet on an annualized basis. The Carrizo-Wilcox Aquifer in Harrison County is projected to have a more than ample supply availability to meet the needs of the City of Scottsville for the planning period.


11568
10413
10413
Deboldin
LEIGH
W.S.C.
Scott
Mimosa Hall
134
Harrison
MARSHALL
POP 23,682
Youree
Memorial
1998
1998
SCOTTSVILLE
POP 283
Motley
UNION
PACIFIC
RAILROAD
CITY OF SCOTTSVILLE
11064
20430
2199
CITY OF MARSHALL
HARRISON
COUNTY
AIRPORT
10363
11628
Butler
Creek
Belview
20
Quapaw
WASKOM RURAL
W.S.C. #1
Eightmile
Granbury
FIVE
NOTCH
St John
Long
Ridge
Big
BLOCKER - CROSSROADS W.S.C.
Blocker
2625
CROSSROADS
BLOCKER - CROSSROADS W.S.C.
2625
12687
10366
Stricklin
Springs
Turkey
Creek
Mt Prospect
12687
ELYSIAN
FIELDS W.S.C.
GILL W.S.C.
10365
ATTACHMENT "A"
CITY OF SCOTTSVILLE
LOCATION MAP

Attachment B - Groundwater Worksheet
City of Scottsville
Harrison County
City and County Other Categories

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
1	300	120	**65**	$ 334.00	$ 100,200.00	$ 2,505.00	$ 102,705.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,000	4	$ 1.67	$ 13,360.00	$ 467.60	$ 13,827.60

Total Construction Cost	**$ 116,532.60**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 34,959.78
ENVIRONMENTAL (LUMP SUM)	$ 10,000.00
Total Borrowed Funds	**$ 161,493.38**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 9,689.60
4% Rate of Return on Investment of Unspent Funds	$ 3,229.87
Net Interest	**$ 6,459.74**
TOTAL CAPITAL COST	**$ 167,953.12**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 9,461.34

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	120	200	70%	1	0.06	$ 1,518.42

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 23,173.16**
WUG Total WMS Cost Per Acre-Foot	**$ 264.65**

City of Scottsville Cost-Savings Analysis for Region D - Rural

Attachment C - Advanced Water Conservation Worksheet

WUG Data	
Population	889
SF Population	889
MF Population	-
Institutional Population	-
SF Units	328
MF Units	-
Average Yearly Rainfall (inches)	43.3
SF Household Size	2.71
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	1.2
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit													
SF Showerheads and Aerators													
SF Clothes Washer Rebate	5.6	15.2	1.0	15.2	0%	90%	295	4,481	5.02	$ 120	$ 35,429	$ 751	rebate from water utility only
SF Irrigation Audit-High User	18.5	50.0	1.0	50.0	1%	5%	13	656	0.73	$ 70	$ 919	$ 459	staff
SF Rainwater Harvesting	17.6	47.6	1.0	47.6	0%	5%	16	781	0.88	$ 250	$ 4,101	$ 451	rebate
SF Rain Barrels	1.9	5.2	1.0	5.2	0%	30%	98	508	0.57	$ 45	$ 4,429	$ 750	rebate or distribution
MF Toilet Retrofit	N/A												
MF Showerheads and Aerators	N/A												
MF Clothes Washer Rebate	N/A												
MF Irrigation Audit	N/A												
MF Rainwater Harvesting	N/A												
									7		$ 44,876.46	$ 685.02	
Commercial													
Commercial Toilet Retrofit	N/A												
Coin-Operated Clothes Washer Rebate	N/A												
Irrigation Audit	N/A												
Commercial General Rebate	N/A												
Commercial Rainwater Harvesting	N/A												

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF TALLEY WSC

Description of Water User Group:

Talley WSC is located in central Harrison County on the west side of the City of Marshall and serves an area west along SH 154 and US Hwy 80. In 2003, the system had 536 members. The population is projected to increase from 1,376 persons in 2010 to 2,020 persons in 2060. The TWSC is included in the County Other water user group for Harrison County. The system's current water supply consists of two water wells that provide water from the Carrizo-Wilcox Aquifer. The total rated capacity of these two wells is 220 GPM, which equates to 118 ac-ft/yr on an annual average basis. The system is bounded on the west by West Harrison WSC and Gum Springs WSC, on the north by Harleton WSC and Cypress Valley WSC, on the east by the City of Marshall, and on the south by Gill WSC. TWSC does not have a water conservation plan or a drought management plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	1376	1543	1664	1756	1862	2020
Projected Water Demand	177	199	215	227	240	260
Current Water Supply	118	118	118	118	118	118
Projected Supply Surplus(+)/Deficit(-)	**-59**	**-81**	**-97**	**-109**	**-122**	**-142**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the TWSC water supply shortages as summarized in the following table. Advanced conservation was omitted from consideration because the per capita use per day was below the 140 gpcpd threshold set by the water planning group. Water reuse was omitted because the TWSC does not have a centralized sewerage collection system. Surface water alternatives were omitted since there is not a supply source within close proximity to the BCWSC and surface water treatment is not economically feasible for a system of this size. A groundwater worksheet is included as Attachment B.

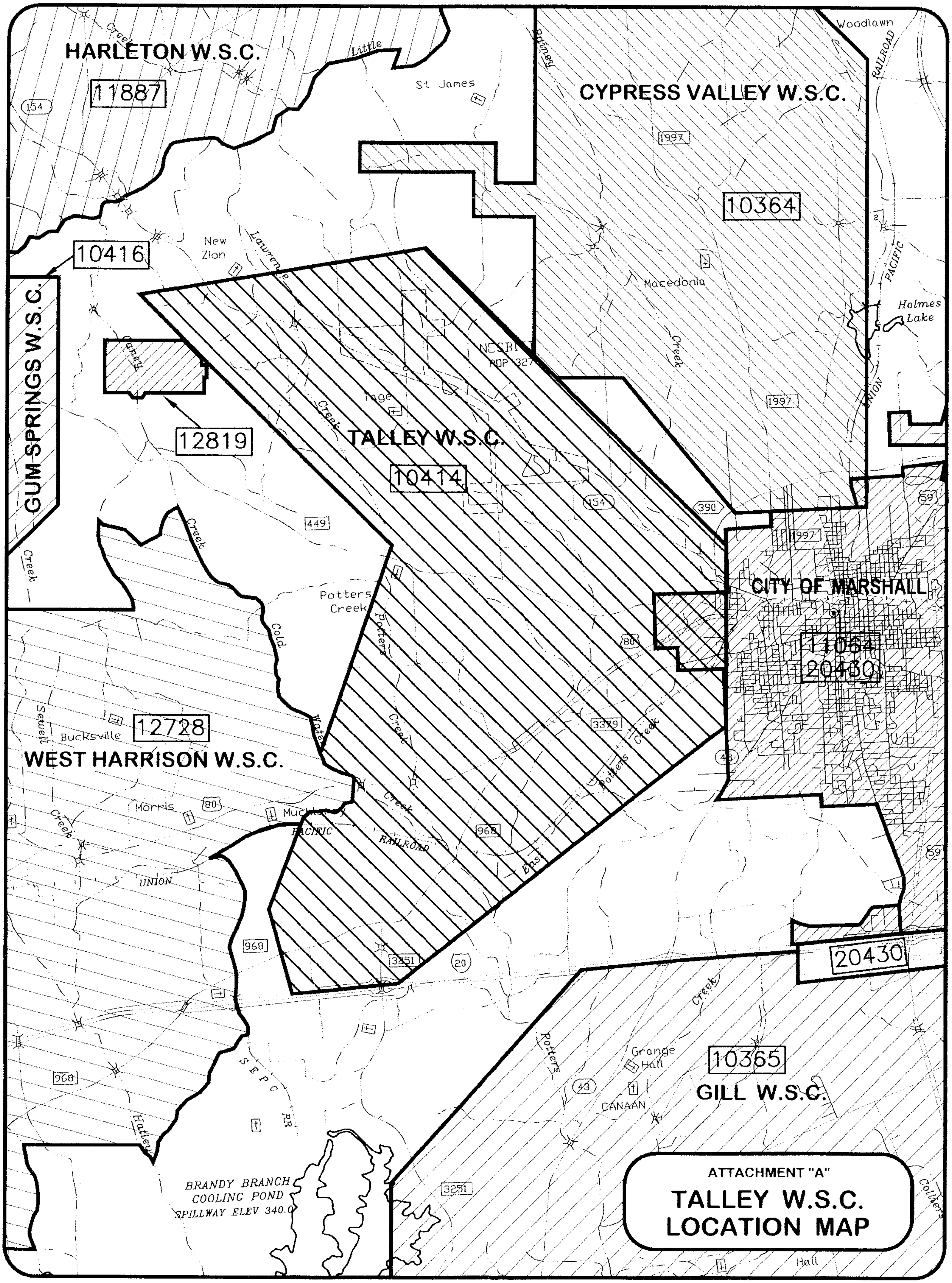
Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**177**	**$ 760,772**	**$ 84,382**	**$ 320**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	59	118	118	118	177	177

The recommended strategy for the Talley WSC to meet their projected deficit of 59 acre-feet in the year 2010 and 142 acre-feet in the year 2060 would be to construct one additional water well prior to 2010, one additional well prior to 2020, and one additional well prior to 2050. The three wells will need to average 110 gpm each. The recommended supply source will be the Carrizo-Wilcox Aquifer in Harrison County. A well with rated capacity of 110 gpm would provide approximately 59 acre-feet on an annualized basis. The Carrizo-Wilcox Aquifer in Harrison County is projected to have a more than ample supply availability to meet the needs of TWSC for the planning period. TWSC has been evaluating well sites and plans to construct one additional well in the near future.

Given the increasing costs to comply with more stringent regulations and the decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be disregarded and a re-evaluation completed.


HARLETON W.S.C.
11887
CYPRESS VALLEY W.S.C.
10364
10416
GUM SPRINGS W.S.C.
12819
TALLEY W.S.C.
10414
CITY OF MARSHALL
11064
20430
12728
WEST HARRISON W.S.C.
20430
10365
GILL W.S.C.
New Zion
St James
Macedonia
Holmes Lake
Woodlawn
NESBITT
Tage
Potters Creek
Bucksville
Morris
Grange Hall
CANAAN
BRANDY BRANCH COOLING POND SPILLWAY ELEV 340.0
ATTACHMENT "A"
TALLEY W.S.C. LOCATION MAP

Attachment B - Groundwater Worksheet
Talley WSC
Harrison County
County Other Category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
3	500	110	**177**	$ 334.00	$ 501,000.00	$ 12,525.00	$ 513,525.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
6,000	4	$ 1.67	$ 40,080.00	$ 1,402.80	$ 41,482.80

Total Construction Cost	**$ 555,007.80**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 166,502.34
ENVIRONMENTAL (LUMP SUM)	$ 10,000.00
Total Borrowed Funds	**$ 731,511.14**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 43,890.67
4% Rate of Return on Investment of Unspent Funds	$ 14,630.22
Net Interest	**$ 29,260.45**
TOTAL CAPITAL COST	**$ 760,771.59**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 26,018.70

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	110	150	70%	3	0.06	$ 3,131.73

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 84,382.45**
WUG Total WMS Cost Per Acre-Foot	**$ 319.92**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

HOPKINS COUNTY

WUGs:

None

County Other:

Miller Grove WSC

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF MILLER GROVE WATER SUPPLY CORPORATION IN HOPKINS COUNTY

Description of Water User Group:

Miller Grove WSC, which is within the County Other systems in Hopkins County, is a small public water supply located primarily in southwestern Hopkins County. The system serves customers in Hopkins, Hunt and Rains counties. The population served in Hopkins County is projected to be 1019 persons in 2010 and increasing to 1071 persons in 2060. Current sources of supply for the WSC are seven wells into the Nacatoch aquifer with a total rated capacity of 412 gpm, which equates to 222 ac-ft/yr on an annual average basis. All wells are located in Hopkins County. The portion of the WUG in Hopkins County is projected to have a water supply deficit of 24 ac-ft/yr beginning in 2030. No shortage is projected for users in Hunt and Rains County. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	1019	1143	1218	1265	1168	1071
Projected Water Demand	146	160	167	170	156	143
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	161	166	143	140	139	137
Projected Supply Surplus (+) / Deficit (-)	**15**	**6**	**-24**	**-30**	**-17**	**-6**

Evaluation of Potentially Feasible Water Management Strategies:

Advanced conservation was not selected for Miller Grove WSC since per capita water use is less than 140 gallons per capita per day. The system is too small to treat its own surface water in a cost-effective manner, but a purchased water supply was considered, from the City of Sulphur Springs. Water reuse was not considered a viable alternative since there is no centralized wastewater collection system. Ground water was considered as the system's primary source to meet the projected deficit. A ground water worksheet, Attachment B, and a surface water purchase worksheet, Attachment C, are included.

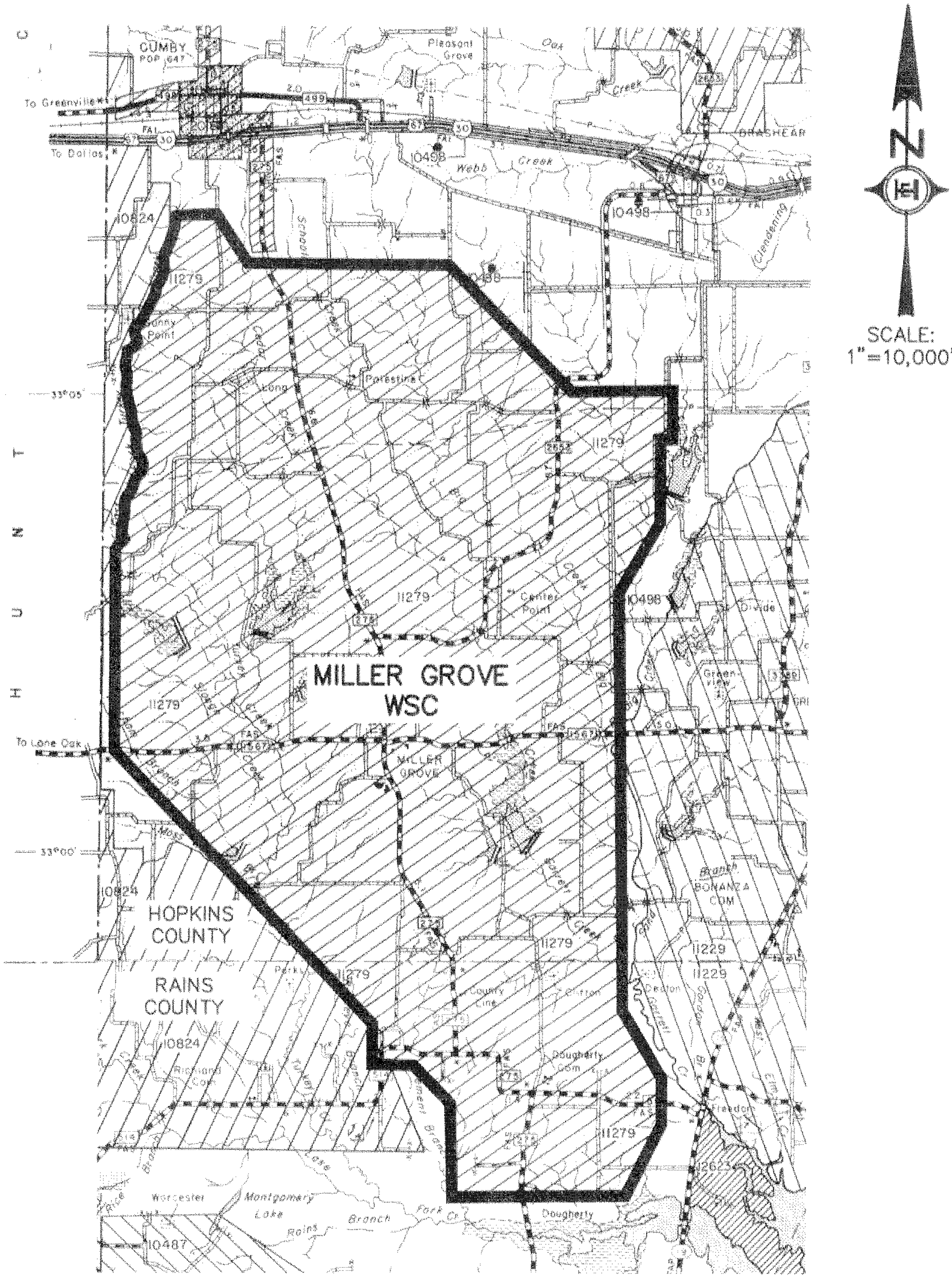
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**35**	**$479,955**	**$40,669**	**$955**	**Minimal**
Surface Water	**30**	**$853,386**	**$46,456**	**$2,445**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	0	0	35	35	35	35

Additional ground water from the Nacatoch aquifer is the recommended strategy for Miller Grove WSC to meet the projected deficit in 2030. One additional well with a rated capacity of 65 gpm would provide approximately 35 ac-ft/y. This additional well, plus the supply from the existing wells, is sufficient to meet the demand till 2060. The WSC has a total storage of 0.191 MG This storage meets the TCEQ's total storage requirement of 200 gallons/connection and is adequate for the projected growth of the WSC.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be re-evaluated.



ATTACHMENT "A"
MILLER GROVE WSC
LOCATION MAP

Attachment B - Groundwater worksheet
Miller Grove WSC
Hopkins County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
1	900	65	**35**	$ 334.00	$ 300,600.00	$ 3,006.00	$ 303,606.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,600	6	$ 2.23	$ 34,788.00	$ 1,217.58	$ 36,005.58

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
-	-	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 339,611.58**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**

Other Capital Costs

ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 101,883.47
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 461,495.05**

INTEREST DURING CONSTRUCTION(IDC):	6% Annual Interest on Total Borrowed Funds	$ 27,689.70
	4% Rate of Return on Investment of Unspent Funds	$ 9,229.90
	Net Interest	**$ 18,459.80**

TOTAL CAPITAL COST **$ 479,954.86**

OPERATION & MAINTENANCE COSTS $ 5,124.89
(Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	65	170	70%	1	0.06	$ 699.10

TOTAL ANNUALIZED COST **$ 40,668.72**
(O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))

WUG Total WMS Cost Per Acre-Foot **$ 954.67**

Attachment C - Purchased Supply Worksheet
Miller Grove WSC
Hopkins County

Water Purchase Contract With City of Sulphur Springs:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
26,782	**30.0**	$ 2.50

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	
1	$ 176,000.00	$ 176,000.00	$ 1,760.00	$ 177,760.00

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
42,240	6	$ 1.67	$ 423,244.80	$ 14,813.57	$ 438,058.37

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 615,818.37**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 184,745.51
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 820,563.88**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 49,233.83
4% Rate of Return on Investment of Unspent Funds	$ 16,411.28
Net Interest	**$ 32,822.56**
TOTAL CAPITAL COST	**$ 853,386.43**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	24	30	30	30	19
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ 19,551.06	$ 24,438.83	$ 24,438.83	$ 24,438.83	$ 15,477.92
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ 61,955.86**	**$ 81,506.92**	**$ 86,394.68**	**$ 24,438.83**	**$ 24,438.83**	**$ 46,455.85**

UNIT COST
($ / ac-ft / yr) **$ 2,445.04**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

HUNT COUNTY

WUGs:

Able Springs WSC
Campbell WSC
Cash SUD
City of Celeste
Combined Consumers WSC
Hickory Creek SUD
North Hunt WSC
Steam Electric
Wolfe City

County Other:

Jacobia WSC
Little Creek Acres
Maloy WSC
Poetry WSC
Shady Grove WSC
West Leonard WSC

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF ABLE SPRINGS WATER SUPPLY CORPORATION IN HUNT COUNTY

Description of Water User Group:

Able Springs Water Supply Corporation is a public water supply located primarily in Kaufman County and supplies consumers in Kaufman, Hunt and Van Zandt counties. Approximately 11% of Able Springs's consumer demand is located in Hunt County. Current water supply is from the Sabine River Authority (SRA) and City of Terrell. Approximately 91% of the supply is from the SRA. In Hunt County, the WSC is projected to have a supply deficit of 47 ac-ft/yr in 2050 and increasing to a deficit of 143 in 2060. Able Springs WSC will need a contract increase in order to supply this projected shortage. Normally, the WSC would request a contract increase from SRA, but the authority has allocated all Lake Tawakoni and Lake Fork water to its existing customers. SRA is proposing to transfer water from the Toledo Bend Reservoir to meet anticipated needs of its customers in the upper Sabine basin. Water from Toledo Bend will be used to meet Able Springs's needs beginning 2050. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Population	418	517	659	896	1423	2250
Projected Water Demand	44	62	78	104	166	262
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	119	119	119	119	119	119
Projected Supply Surplus (+) / Deficit (-)	**75**	**57**	**41**	**15**	**-47**	**-143**

Evaluation of Potentially Feasible Water Management Strategies:

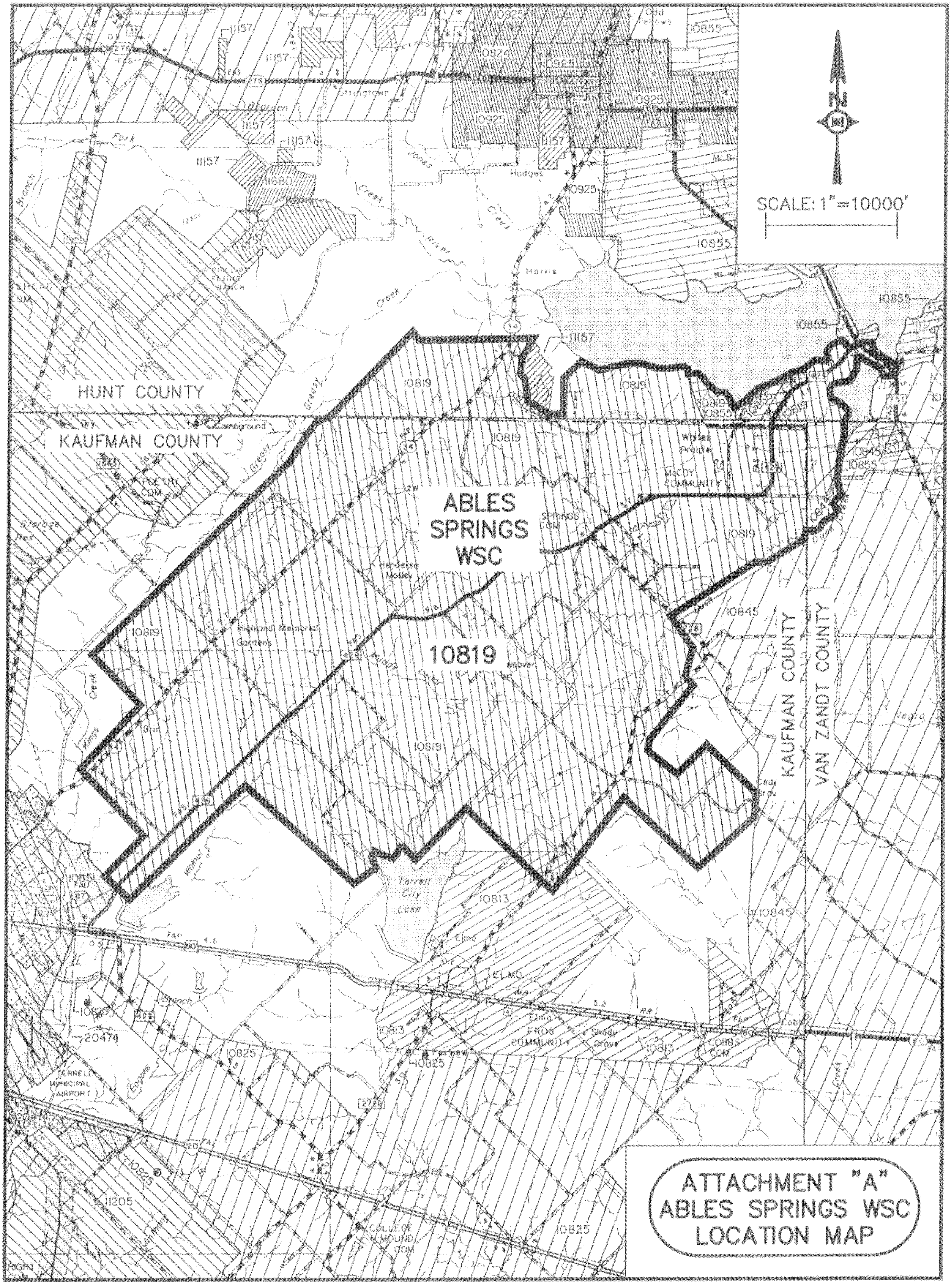
The four alternative strategies considered to meet Able Springs WSC's water supply shortages are listed in the table below. Advanced conservation was not selected since per capita use is less than 140 gpcpd. There are no significant current water needs that could be met by water reuse. Groundwater was not selected because the WSC plans to continue using surface water for its needs. Consequently, surface water was considered as the alternative to meet projected demands. Surface water worksheet is included as Attachment B.

Strategy	**Firm Yield (ac-ft)**	**Total Capital Cost**	**Total Annual Cost**	**Unit Cost**	**Environmental Impact**
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**143**	**-**	**$2,992**	**$94.5**	**Minimal**

Recommendations:

	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Surface Water (ac-ft/yr)	**0**	**0**	**0**	**0**	**47**	**143**

The recommended strategy for Able Springs WSC to meet their projected deficit from 2050 is to purchase raw water from the Sabine River Authority's proposed Toledo Bend Transfer.



SCALE: 1"=10000'
HUNT COUNTY
KAUFMAN COUNTY
VAN ZANDT COUNTY
ABLES
SPRINGS
WSC
10819
10813
10825
10845
10855
10925
11157
11205
20474
TERRELL MUNICIPAL AIRPORT
ELMO
FROG COMMUNITY
COBBS COM
McCOY COMMUNITY
COLLEGE MOUND COM
Terrell City Lake
ATTACHMENT "A"
ABLES SPRINGS WSC
LOCATION MAP

Attachment B - Purchased Supply Worksheet
Able Springs WSC
Hunt County

Water Purchase Contract With Sabine River Authority (proposed Toledo Bend tranfer):

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)	
127,662	**143**	$ 0.83	Pre-Amortization 2010 to 2040
		$ 0.29	After Amortization 2050 to 2060

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
-	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Ground Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	0	0	47	143	32
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ -	$ -	$ 4,441.35	$ 13,513.04	$ 2,992.40
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ -**	**$ -**	**$ -**	**$ 4,441.35**	**$ 13,513.04**	**$ 2,992.40**

UNIT COST
($ / ac-ft / yr) **$ 94.50**

Attachment C					
Cost of Transferring Water from Toledo Bend to Upper Sabin Basin					
Owners:					
Amount-Toledo Bend (Total):	500000				
-SRA	100000				
-NTMWD	200000				
-TRWD	200000				
Segments:		**SRA**	**NTMWD**	**TRWD**	**Flow (Ac-ft)**
Toledo Bend to Longview	TB1	20%	40%	40%	500000
Construction Costs:					
-Transmission Facilities					
	Size	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline-TB1	2-108 in.	366,400	LF	$ 633.00	$ 463,862,400
Right of Way Easements (rural)		665	Acre	$ 3,000.00	$ 1,993,963
Permitting and Mitigation			LS		$ 3,650,442
					$ 469,506,805
Engineering and Contingencies (30%)					$ 140,852,042
Subtotal of Pipeline					**$ 610,358,847**
-Pump Station(s)					
Intake and Pump Station - TB1			HP		$ 27,660,000
Booster Pump Station - TB1			HP		$ 20,500,000
Permitting and Mitigation					$ 356,292
					$ 48,516,292
Engineering and Contingencies (35%)					$ 16,980,702
Subtotal of Pump Station(s)					**$ 65,496,995**
-Storage Tanks					
	Size	**Quantity**	**Unit**	**Unit Price**	**Cost**
Storage TB1	10MG	7	Ea	$ 1,400,000	$ 9,800,000
Permitting and Mitigation					$ 85,885
					$ 9,885,885
Engineering and Contingencies (35%)					$ 3,460,060
Subtotal of Storage Tanks					**$ 13,345,944**
Construction Total					**$ 689,201,786**
Interest During Construction			(36 months)		**$ 82,704,214**
Total Cost					**$ 771,906,000**
Total Cost by User					
-SRA					$ 154,381,200
-NTMWD					$ 308,762,400
-TRWD					$ 308,762,400
Annual Cost Pre-Amortization					
Debt Service(6% for 30 years)					
-SRA					$ 11,208,075
-NTMWD					$ 22,416,150
-TRWD					$ 22,416,150
Raw Water and Operating Costs					

Cost of Transferring Water from Toledo Bend to Upper Sabin Basin

Total							
-SRA							$ 6,175,248
-NTMWD							$ 12,350,496
-TRWD							$ 12,350,496
Total Annual Costs							
-SRA							$ 17,383,323
-NTMWD							$ 34,766,646
-TRWD							$ 34,766,646
Segments:			**SRA**	**NTMWD**	**TRWD**		**Flow (Ac-ft)**
Longview to Lake Fork		TB2	11%	44%	44%		450000
Construction Costs:							
-Transmission Facilities							
		Size	**Quantity**	**Unit**	**Unit Price**		**Cost**
Pipeline-TB2		2-102 in.	240,800	LF	$	565.00	$ 272,104,000
Right of Way Easements (rural)			437	Acre	$	3,000.00	$ 1,310,443
Permitting and Mitigation				LS			$ 2,399,089
							$ 275,813,533
Engineering and Contingencies (30%)							$ 82,744,060
Subtotal of Pipeline							**$ 358,557,592**
-Pump Station(s)							
Booster Pump Station - TB2				HP			$ 14,000,000
Permitting and Mitigation							$ 234,157
							$ 14,234,157
Engineering and Contingencies (35%)							$ 4,981,955
Subtotal of Pump Station(s)							**$ 19,216,112**
-Storage Tanks							
		Size	**Quantity**	**Unit**	**Unit Price**		**Cost**
Storage TB2		10MG	6	Ea	$	1,400,000	$ 8,400,000
Permitting and Mitigation							$ 73,615
							$ 8,473,615
Engineering and Contingencies (35%)							$ 2,965,765
Subtotal of Storage Tanks							**$ 11,439,381**
Construction Total							**$ 389,213,085**
Interest During Construction				(36 months)			**$ 46,705,570**
Total Cost							**$ 435,918,656**
Total Cost by User							
-SRA							$ 48,435,406
-NTMWD							$ 193,741,625
-TRWD							$ 193,741,625
Annual Cost Pre-Amortization							
Debt Service(6% for 30 years)							
-SRA							$ 3,516,410
-NTMWD							$ 14,065,642
-TRWD							$ 14,065,642
Raw Water and Operating Costs							

Total							
-SRA							$ 1,937,416
-NTMWD							$ 7,749,665
-TRWD							$ 7,749,665
Total Annual Costs							
-SRA							$ 5,453,827
-NTMWD							$ 21,815,307
-TRWD							$ 21,815,307

Segments:				**SRA**	**NTMWD**	**TRWD**	**Flow (Ac-ft)**
Lake Fork to Tawakoni		A1		20%	0%	80%	250000
Construction Costs:							
-Transmission Facilities							
			Size	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline-A1			2-78 in.	142,040	LF	$ 364.00	$ 103,405,120
Right of Way Easements (rural)				1359	Acre	$ 3,000.00	$ 4,077,394
Permitting and Mitigation					LS		$ 7,464,675
							$ 114,947,189
Engineering and Contingencies (30%)							$ 34,484,157
Subtotal of Pipeline							**$ 149,431,346**
-Pump Station(s)							
-Storage Tanks							
Construction Total							**$ 149,431,346**
Interest During Construction					(36 months)		**$ 17,931,762**
Total Cost							**$ 167,363,107**
Total Cost by User							
-SRA							$ 33,472,621
-NTMWD							$ -
-TRWD							$ 133,890,486
Annual Cost Pre-Amortization							
Debt Service(6% for 30 years)							
-SRA							$ 2,430,112
-NTMWD							$ -
-TRWD							$ 9,720,449
Raw Water and Operating Costs							
Total							
-SRA							$ 1,338,905
-NTMWD							$ -
-TRWD							$ 5,355,619
Total Annual Costs							
-SRA							$ 3,769,017
-NTMWD							$ -
-TRWD							$ 15,076,069

Segments:							

Cost of Transferring Water from Toledo Bend to Upper Sabin Basin

Toledo Bend to Longview to Lake Fork to Lake Tawakoni		
Total Annual Cost Pre-Amortization		
-SRA	$	26,606,167
-NTMWD	$	56,581,953
-TRWD	$	71,658,022
Unit Cost Pre-Amortization		
Per Acre-Foot		
-SRA	$	266
-NTMWD	$	283
-TRWD	$	358
Per 1000 gallons		
-SRA	**$**	**0.83**
-NTMWD	$	0.88
-TRWD	$	1.11
Total Annual Cost After-Amortization		
-SRA	$	9,451,569
-NTMWD	$	20,100,161
-TRWD	$	25,455,780
Unit Cost After-Amortization		
Per Acre-Foot		
-SRA	$	95
-NTMWD	$	101
-TRWD	$	127
Per 1000 gallons		
-SRA	**$**	**0.29**
-NTMWD	$	0.31
-TRWD	$	0.40

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CAMPBELL WATER SUPPLY CORPORATION

Description of Water User Group:

Campbell WSC is a small public water supply located in eastern Hunt County. The system is projected to serve 610 people in 2010 and 5917 people by the year 2060. The current sources of supply are four wells into the Nacatoch Aquifer with a production capacity ranging from 60 gpm to 120 gpm. The WSC provides water to its own customers in the Sulphur and Sabine basins and also supplies the City of Campbell. Campbell WSC is projected to have a water supply deficit of 9 ac-ft/yr by 2010. The deficit is projected to increase to 773 ac-ft/yr by 2060. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	610	892	1303	1986	3516	5917
Projected Water Demand	78	115	168	256	453	762
Water Demand from other entities	109	109	111	123	149	189
Current Water Supply	178	178	178	178	178	178
Projected Supply Surplus (+) / Deficit (-)	**-9**	**-46**	**-101**	**-201**	**-424**	**-773**

Evaluation of Potentially Feasible Water Management Strategies:

The four alternative strategies considered to meet Campbell's water supply shortages are listed in the table below. Advanced conservation was not selected since per capita use is less than 140 gpcpd. There are no significant current water needs in Campbell that could be met by water reuse. Groundwater from the Nacatoch Aquifer and purchase of surface water from the City of Commerce were the alternatives selected for this entity. Groundwater worksheet - Attachment B, and surface water work sheet - Attachment C, are included herein.

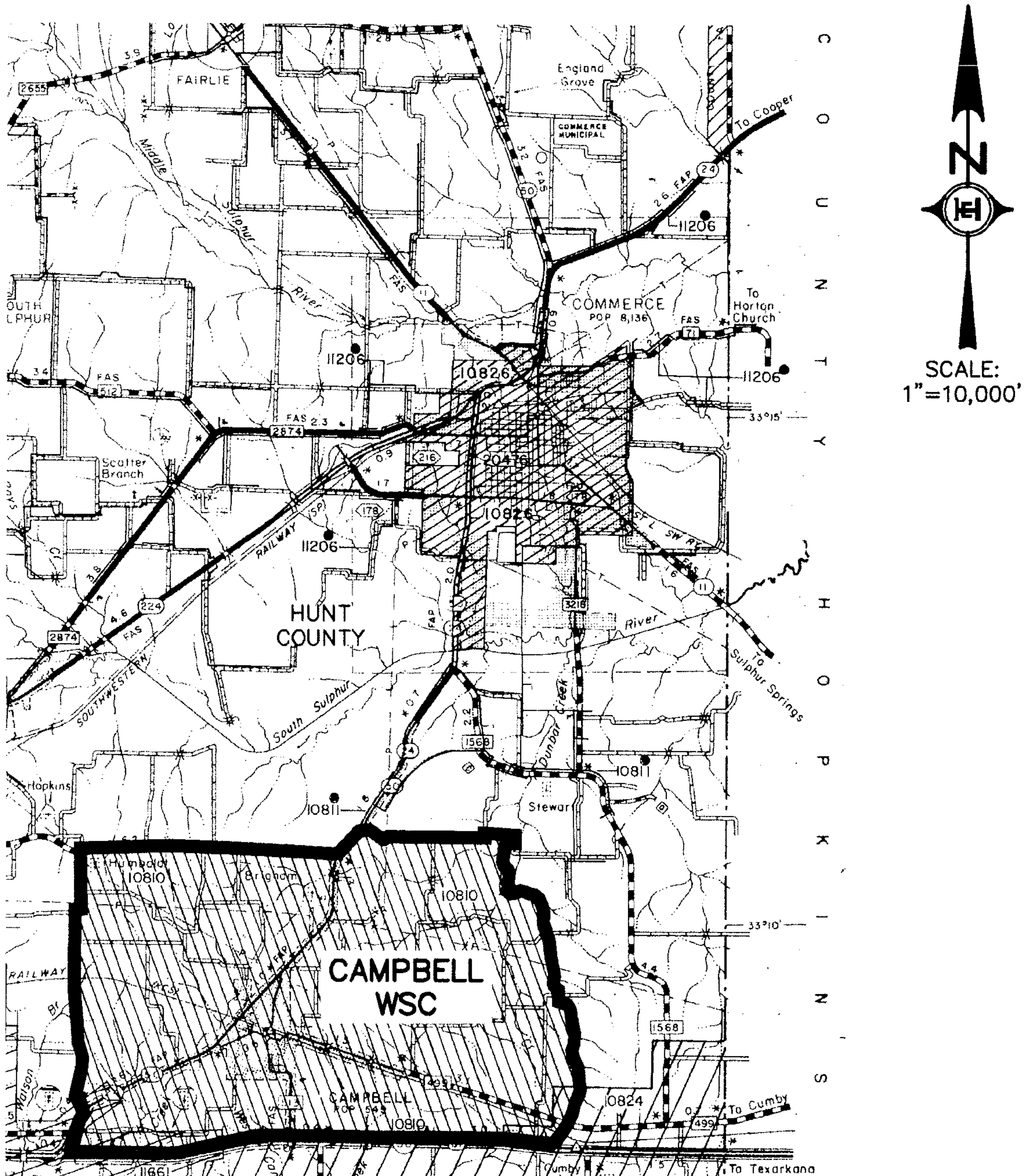
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**108**	**$618,674**	**$61,950**	**$366**	**Minimal**
Surface Water	**665**	**$717,434**	**$201,025**	**$1,123**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	108	108	108	108	108	108
Surface Water (ac-ft/yr)				93	316	665

The recommended strategy for Campbell WSC to meet their projected deficit from 2010 till 2030 is to construct two new wells, each with a rated capacity of 100 gpm, which would provide approximately 108 ac-ft/yr. To meet demand from 2040 till 2060, it is recommended that Campbell WSC enter into a treated water contract with the City of Commerce, the source of water being Lake Tawakoni.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be re-evaluated.



ATTACHMENT "A"
CAMPBELL WSC
LOCATION MAP

Attachment B - Groundwater worksheet
Campbell WSC
Hunt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
2	360	100	**108**	$ 334.00	$ 240,480.00	$ 2,404.80	$ 242,884.80

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
5,000	6	$ 2.23	$ 66,900.00	$ 2,341.50	$ 69,241.50

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
1	230000	$ 0.56	$ 128,800.00	$ 1,288.00	$ 130,088.00

Total Construction Cost	**$ 442,214.30**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 132,664.29
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 594,878.59**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 35,692.72
4% Rate of Return on Investment of Unspent Funds	$ 11,897.57
Net Interest	**$ 23,795.14**
TOTAL CAPITAL COST	**$ 618,673.73**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 15,768.91

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	100	100	70%	2	0.06	$ 1,265.35

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 61,949.97**
WUG Total WMS Cost Per Acre-Foot	**$ 365.67**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CASH WATER SUPPLY CORPORATION

Description of Water User Group:

Cash Water Supply Corporation is a public water supply located primarily in Hunt County. The water supply corporation sells water to Combined Consumers WSC, Aqua Source Utility, City of Lone Oak and City of Quinlan. In addition to meeting the needs of its retail customers, Cash supplies water to consumers in Hunt, Hopkins, Rains and Rockwall counties. Approximately 90% of Cash's demand is located in Hunt County. Current water supply is from the Sabine River Authority (SRA) and North Texas Municipal Water District (NTMWD). Approximately 76% of water supply to Cash WSC is from SRA, and Cash plans to buy additional water from this source to meet their future needs. Cash is projected to have a supply deficit of 4305 ac-ft/yr around 2060, and will need a contract increase in order to supply this projected shortage. Normally, Cash would request a contract increase from SRA, but the authority has allocated all Lake Tawakoni and Lake Fork water to its existing customers. SRA is proposing to transfer water from Toledo Bend Reservoir to meet anticipated needs of its customers. Water from Toledo Bend will be used to meet Cash WSC needs in 2060.

Cash WSC has a contract with NTMWD for 1792 ac-ft/yr. Region C's tabulations show NTMWD as not having sufficient water to meet all their contractual obligation to Cash WSC. Consequently, Region C has developed tables to show current and future allocation to Cash WSC from NTMWD. A location map for Cash WSC is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	13401	16574	21155	28728	45657	72191
Projected Water Demand	1939	2400	3030	4037	6244	9693
Water Demand from other entities	1025	1025	1025	1025	1025	1025
Current Water Supply	7060	6776	6636	6538	6471	6413
Projected Supply Surplus (+) / Deficit (-)	**4096**	**3351**	**2581**	**1476**	**-798**	**-4305**

Evaluation of Potentially Feasible Water Management Strategies:

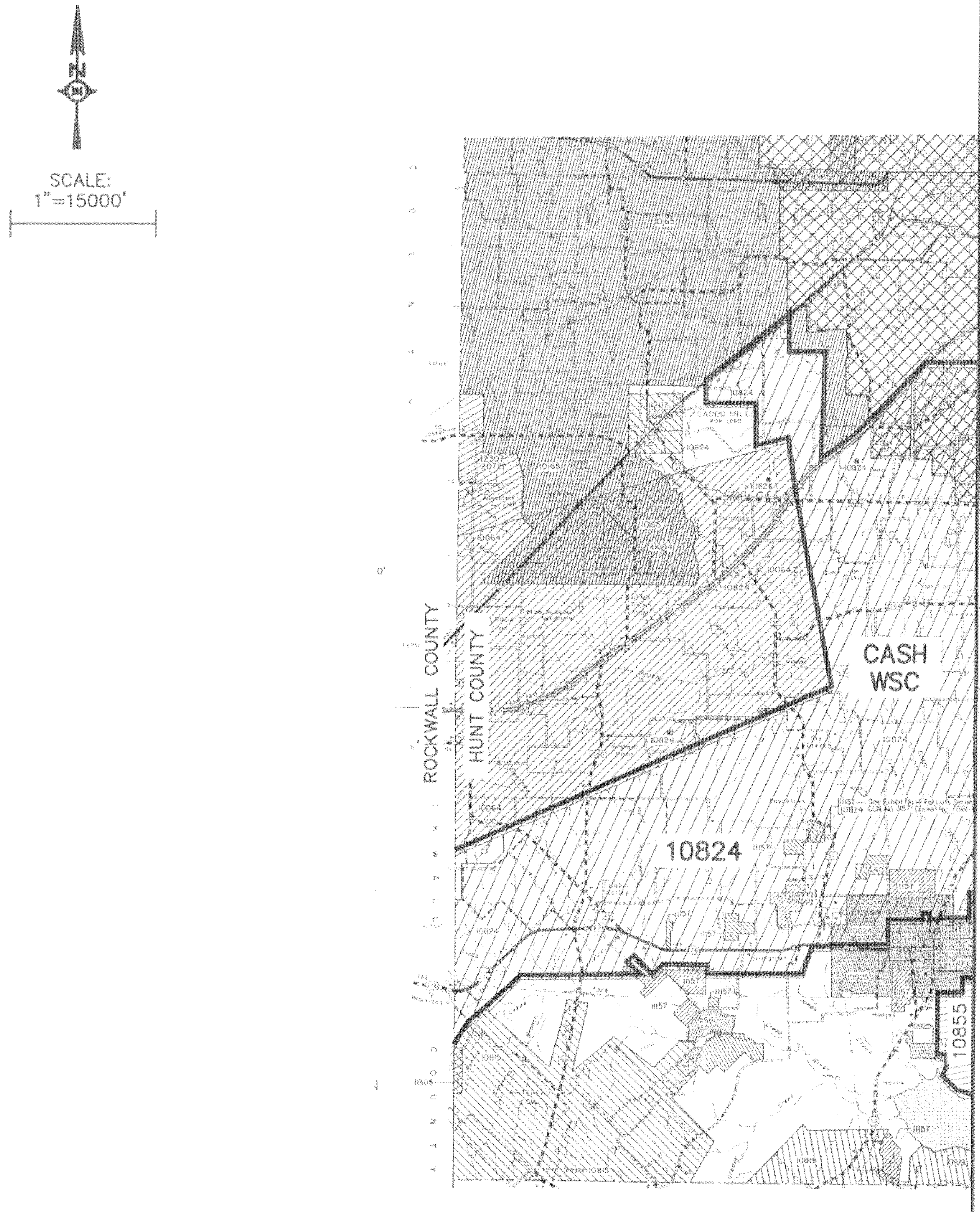
The four alternative strategies considered to meet Cash WSC's water supply shortages are listed in the table below. Advanced conservation was not selected since per capita use is less than 140 gpcpd. There are no significant current water needs in Cash that could be met by water reuse. Groundwater was not selected because it is inadequate in quality and quantity for supplies of this size. Consequently, surface water was selected as the alternative to meet projected demands. Surface water worksheet for region D strategy is included as Attachment B.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water (NTMWD)	**1184**	-	-	-	-
Surface Water (Toledo Bend)	**3121**	-	**$49,154**	**$95**	**Minimal**

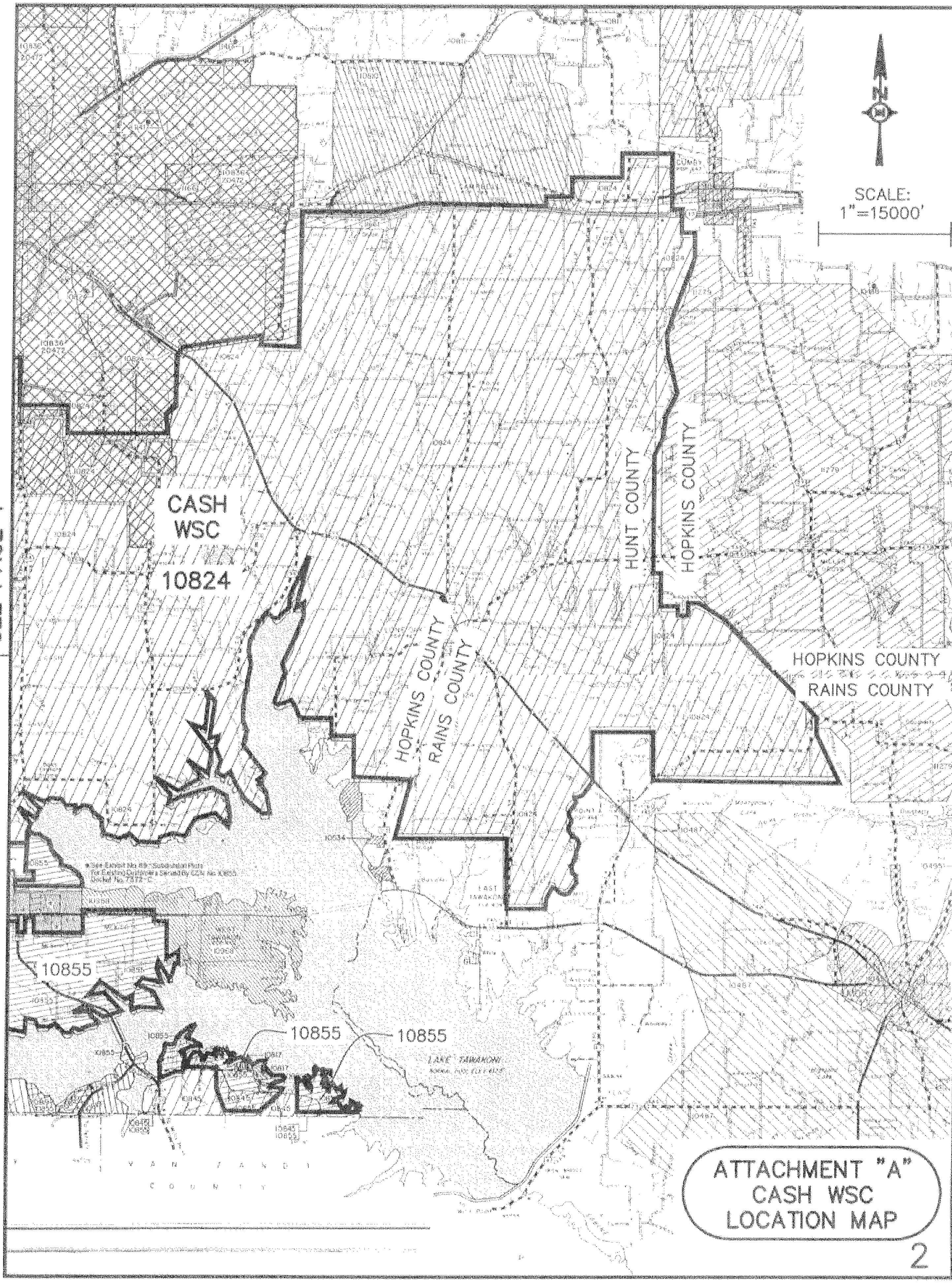
Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water - Toledo Bend (ac-ft/yr)	**0**	**0**	**0**	**0**	**0**	**3121**
Surface Water - NTMWD future allocation (ac-ft/yr)	**537**	**821**	**961**	**1059**	**1126**	**1184**

The recommended strategy for Cash WSC to meet their projected deficit in 2060 is to purchase raw water from the Sabine River Authority's proposed Toledo Bend Transfer. Also, Region C has developed strategies to meet NTMWD's contractual obligation to Cash WSC.



ATTACHMENT "A"
CASH WSC
LOCATION MAP


SCALE:
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CASH
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SEE PAGE 1
HUNT COUNTY
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RAINS COUNTY
10855
10855
10855
LAKE TAWAKONI
VAN ZANDT
COUNTY
ATTACHMENT "A"
CASH WSC
LOCATION MAP

Attachment B - Purchased Supply Worksheet
Cash WSC
Hunt County

Water Purchase Contract With NTMWD (C50.1, Texoma Lake/Reservoir Non-System Portion):

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
133,911	**150**	$ 1.02

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
-	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	8	$ 1.67	$ -	$ -	$ -

Ground Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	54	167	113	90	149	150	121
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 17,947.87	$ 55,505.46	$ 37,557.59	$ 29,913.12	$ 49,522.83	$ 49,855.20	$ 40,050.35
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 17,947.87**	**$ 55,505.46**	**$ 37,557.59**	**$ 29,913.12**	**$ 49,522.83**	**$ 49,855.20**	**$ 40,050.35**

UNIT COST
($ / ac-ft / yr) **$ 332.37**

Attachment B - Purchased Supply Worksheet
Cash WSC
Hunt County

Water Purchase Contract With NTMWD (C50.1, Toledo Bend Lake/Reservoir):

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
133,911	**150**	$ 1.02

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
-	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	8	$ 1.67	$ -	$ -	$ -

Ground Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	0	0	148	150	50
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ -	$ -	$ 49,190.47	$ 49,855.20	$ 16,507.61
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ -**	**$ -**	**$ -**	**$ 49,190.47**	**$ 49,855.20**	**$ 16,507.61**

UNIT COST
($ / ac-ft / yr) **$ 332.37**

Attachment B - Purchased Supply Worksheet
Cash WSC
Hunt County

Water Purchase Contract With NTMWD (C50.2, Indirect Reuse):

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
267,823	**300**	$ 1.02

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
-	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	8	$ 1.67	$ -	$ -	$ -

Ground Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	476	314	300	300	300	300	332
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 158,207.18	$ 104,363.56	$ 99,710.41	$ 99,710.41	$ 99,710.41	$ 99,710.41	$ 110,235.39
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 158,207.18**	**$ 104,363.56**	**$ 99,710.41**	**$ 99,710.41**	**$ 99,710.41**	**$ 99,710.41**	**$ 110,235.39**

UNIT COST
($ / ac-ft / yr) **$ 332.37**

Attachment B - Purchased Supply Worksheet
Cash WSC
Hunt County

Water Purchase Contract With NTMWD (C50.3, Lower Bois D Arc Lake/Reservoir):

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
407,983	**457**	$ 1.02

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
-	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	8	$ 1.67	$ -	$ -	$ -

Ground Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	315	497	613	440	457	387
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ 104,695.93	$ 165,186.91	$ 203,741.60	$ 146,241.93	$ 151,892.19	$ 128,626.42
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ 104,695.93**	**$ 165,186.91**	**$ 203,741.60**	**$ 146,241.93**	**$ 151,892.19**	**$ 128,626.42**

UNIT COST
($ / ac-ft / yr) **$ 332.37**

Attachment B - Purchased Supply Worksheet
Cash WSC
Hunt County

Water Purchase Contract With Sabine River Authority (proposed Toledo Bend tranfer):

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)	
2,786,249	**3121**	$ 0.83	Pre-Amortization 2010 to 2040
		$ 0.29	After Amortization 2050 to 2060

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
-	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	8	$ 1.67	$ -	$ -	$ -

Ground Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	0	0	0	3121	520
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ -	$ -	$ -	$ 294,924.48	$ 49,154.08
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 294,924.48**	**$ 49,154.08**

UNIT COST
($ / ac-ft / yr) **$ 94.50**

Cost of Transferring Water from Toledo Bend to Upper Sabin Basin

Attachment C						
Cost of Transferring Water from Toledo Bend to Upper Sabin Basin						
Owners:						
Amount-Toledo Bend (Total):		500000				
-SRA		100000				
-NTMWD		200000				
-TRWD		200000				
Segments:			**SRA**	**NTMWD**	**TRWD**	**Flow (Ac-ft)**
Toledo Bend to Longview		TB1	20%	40%	40%	500000
Construction Costs:						
-Transmission Facilities						
		Size	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline-TB1		2-108 in.	366,400	LF	$ 633.00	$ 463,862,400
Right of Way Easements (rural)			665	Acre	$ 3,000.00	$ 1,993,963
Permitting and Mitigation				LS		$ 3,650,442
						$ 469,506,805
Engineering and Contingencies (30%)						$ 140,852,042
Subtotal of Pipeline						**$ 610,358,847**
-Pump Station(s)						
Intake and Pump Station - TB1				HP		$ 27,660,000
Booster Pump Station - TB1				HP		$ 20,500,000
Permitting and Mitigation						$ 356,292
						$ 48,516,292
Engineering and Contingencies (35%)						$ 16,980,702
Subtotal of Pump Station(s)						**$ 65,496,995**
-Storage Tanks						
		Size	**Quantity**	**Unit**	**Unit Price**	**Cost**
Storage TB1		10MG	7	Ea	$ 1,400,000	$ 9,800,000
Permitting and Mitigation						$ 85,885
						$ 9,885,885
Engineering and Contingencies (35%)						$ 3,460,060
Subtotal of Storage Tanks						**$ 13,345,944**
Construction Total						**$ 689,201,786**
Interest During Construction				(36 months)		**$ 82,704,214**
Total Cost						**$ 771,906,000**
Total Cost by User						
-SRA						$ 154,381,200
-NTMWD						$ 308,762,400
-TRWD						$ 308,762,400
Annual Cost Pre-Amortization						
Debt Service(6% for 30 years)						
-SRA						$ 11,208,075
-NTMWD						$ 22,416,150
-TRWD						$ 22,416,150
Raw Water and Operating Costs						

Cost of Transferring Water from Toledo Bend to Upper Sabin Basin

Total						
-SRA						$ 6,175,248
-NTMWD						$ 12,350,496
-TRWD						$ 12,350,496
Total Annual Costs						
-SRA						$ 17,383,323
-NTMWD						$ 34,766,646
-TRWD						$ 34,766,646

Segments:		**SRA**	**NTMWD**	**TRWD**		**Flow (Ac-ft)**
Longview to Lake Fork	TB2	11%	44%	44%		450000
Construction Costs:						
-Transmission Facilities						
	Size	**Quantity**	**Unit**	**Unit Price**		**Cost**
Pipeline-TB2	2-102 in.	240,800	LF	$ 565.00		$ 272,104,000
Right of Way Easements (rural)		437	Acre	$ 3,000.00		$ 1,310,443
Permitting and Mitigation			LS			$ 2,399,089
						$ 275,813,533
Engineering and Contingencies (30%)						$ 82,744,060
Subtotal of Pipeline						**$ 358,557,592**
-Pump Station(s)						
Booster Pump Station - TB2			HP			$ 14,000,000
Permitting and Mitigation						$ 234,157
						$ 14,234,157
Engineering and Contingencies (35%)						$ 4,981,955
Subtotal of Pump Station(s)						**$ 19,216,112**
-Storage Tanks						
	Size	**Quantity**	**Unit**	**Unit Price**		**Cost**
Storage TB2	10MG	6	Ea	$ 1,400,000		$ 8,400,000
Permitting and Mitigation						$ 73,615
						$ 8,473,615
Engineering and Contingencies (35%)						$ 2,965,765
Subtotal of Storage Tanks						**$ 11,439,381**
Construction Total						**$ 389,213,085**
Interest During Construction			(36 months)			**$ 46,705,570**
Total Cost						**$ 435,918,656**
Total Cost by User						
-SRA						$ 48,435,406
-NTMWD						$ 193,741,625
-TRWD						$ 193,741,625
Annual Cost Pre-Amortization						
Debt Service(6% for 30 years)						
-SRA						$ 3,516,410
-NTMWD						$ 14,065,642
-TRWD						$ 14,065,642
Raw Water and Operating Costs						

Total						
-SRA						$ 1,937,416
-NTMWD						$ 7,749,665
-TRWD						$ 7,749,665
Total Annual Costs						
-SRA						$ 5,453,827
-NTMWD						$ 21,815,307
-TRWD						$ 21,815,307

Segments:		**SRA**	**NTMWD**	**TRWD**		**Flow (Ac-ft)**
Lake Fork to Tawakoni	A1	20%	0%	80%		250000
Construction Costs:						
-Transmission Facilities						
	Size	**Quantity**	**Unit**	**Unit Price**		**Cost**
Pipeline-A1	2-78 in.	142,040	LF	$	364.00	$ 103,405,120
Right of Way Easements (rural)		1359	Acre	$	3,000.00	$ 4,077,394
Permitting and Mitigation			LS			$ 7,464,675
						$ 114,947,189
Engineering and Contingencies (30%)						$ 34,484,157
Subtotal of Pipeline						**$ 149,431,346**
-Pump Station(s)						
-Storage Tanks						
Construction Total						**$ 149,431,346**
Interest During Construction			(36 months)			**$ 17,931,762**
Total Cost						**$ 167,363,107**
Total Cost by User						
-SRA						$ 33,472,621
-NTMWD						$ -
-TRWD						$ 133,890,486
Annual Cost Pre-Amortization						
Debt Service(6% for 30 years)						
-SRA						$ 2,430,112
-NTMWD						$ -
-TRWD						$ 9,720,449
Raw Water and Operating Costs						
Total						
-SRA						$ 1,338,905
-NTMWD						$ -
-TRWD						$ 5,355,619
Total Annual Costs						
-SRA						$ 3,769,017
-NTMWD						$ -
-TRWD						$ 15,076,069

Segments:						

Cost of Transferring Water from Toledo Bend to Upper Sabin Basin

Toledo Bend to Longview to Lake Fork to Lake Tawakoni		
Total Annual Cost Pre-Amortization		
-SRA	$	26,606,167
-NTMWD	$	56,581,953
-TRWD	$	71,658,022
Unit Cost Pre-Amortization		
Per Acre-Foot		
-SRA	$	266
-NTMWD	$	283
-TRWD	$	358
Per 1000 gallons		
-SRA	**$**	**0.83**
-NTMWD	$	0.88
-TRWD	$	1.11
Total Annual Cost After-Amortization		
-SRA	$	9,451,569
-NTMWD	$	20,100,161
-TRWD	$	25,455,780
Unit Cost After-Amortization		
Per Acre-Foot		
-SRA	$	95
-NTMWD	$	101
-TRWD	$	127
Per 1000 gallons		
-SRA	**$**	**0.29**
-NTMWD	$	0.31
-TRWD	$	0.40

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF CELESTE

Description of Water User Group:

City of Celeste is a small public water supply located in northwest Hunt County. The system is projected to serve 861 people in 2010 and 2031 people by the year 2060. The current sources of supply are two wells into the Woodbine Aquifer, each with a production capacity of 150 gpm. The City provides water to its own customers in the Sabine basin and is projected to have a water supply deficit of 34 ac-ft/yr in 2050. The deficit is projected to increase to 101 ac-ft/yr by 2060. The system does have a water conservation and drought management plan in place. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	861	932	1028	1180	1513	2031
Projected Water Demand	111	120	132	152	195	262
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	161	161	161	161	161	161
Projected Supply Surplus (+) / Deficit (-)	**50**	**41**	**29**	**9**	**-34**	**-101**

Evaluation of Potentially Feasible Water Management Strategies:

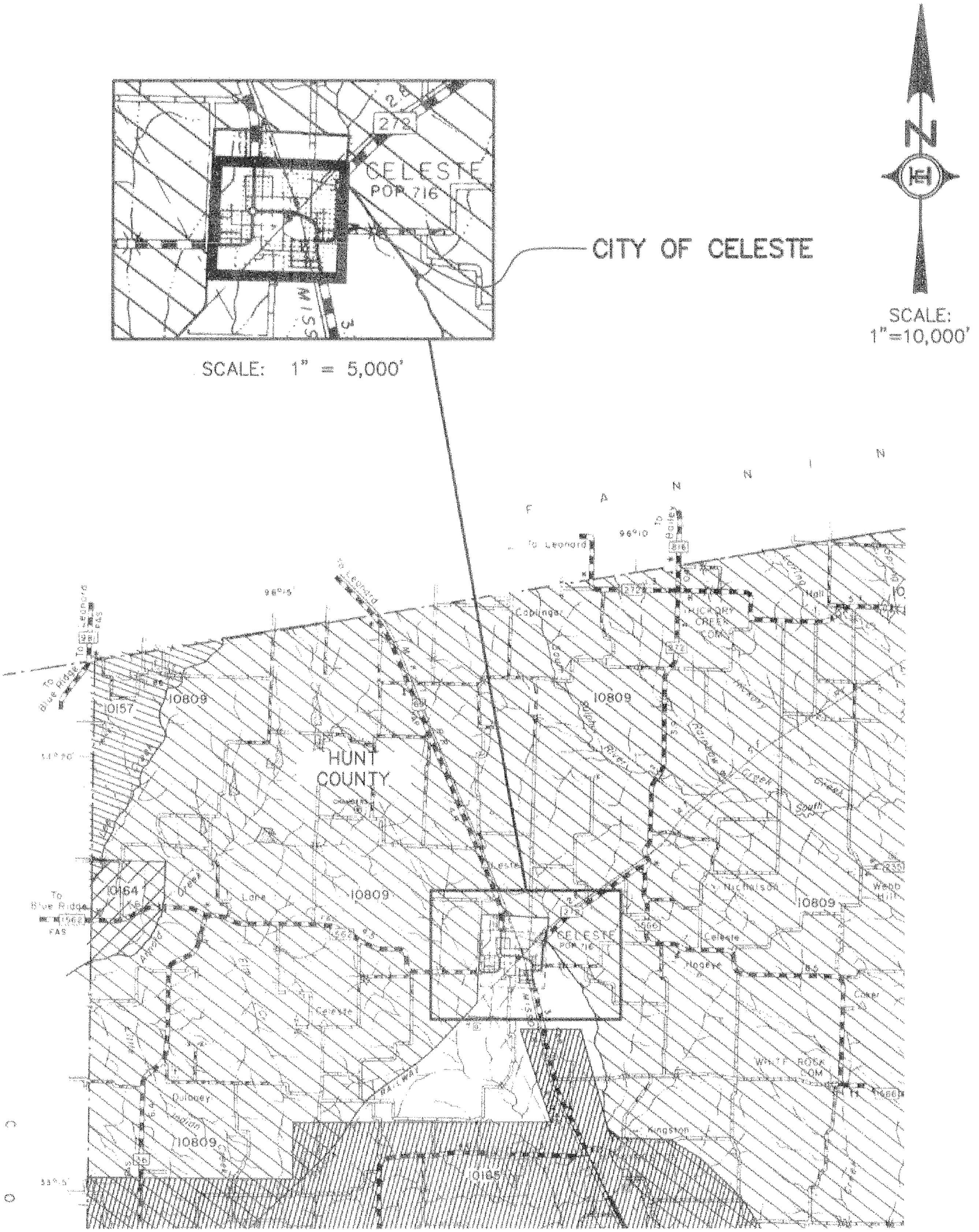
The four alternative strategies considered to meet Celeste's water supply shortages are listed in the table below. Advanced conservation was not selected since per capita use is less than 140 gpcpd. There are no significant current water needs in Celeste that could be met by water reuse. The system is not large enough to treat surface water in a cost-effective manner; however a surface water alternative using purchased water from the City of Greenville was considered. Surface water may also be available by the time needed from the North Texas Municipal Water District. Groundwater from the Woodbine Aquifer was also considered as an alternative for this entity. A groundwater worksheet is included as Attachment B, and a surface water purchase worksheet as Attachment C.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**108**	**$1,938,749**	**$160,318**	**$2,227**	**Minimal**
Surface Water	**101**	**$1,328,431**	**$70,217**	**$3,121**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)					34	101

Because of the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source, surface water alternative was selected as the strategy to meet Celeste's needs. Comparison of costs show that surface water is the economical alternative compared to drilling wells. To meet the City's projected deficit in 2050 and 2060 it is recommended that Celeste enter into a surface water purchase contract with the City of Greenville. In this round of planning, Greenville is projected to have adequate surplus that could be used to meet Celeste's needs.



ATTACHMENT "A"
CITY OF CELESTE
LOCATION MAP

Attachment B - Groundwater worksheet
City of Celeste
Hunt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
2	2000	100	**108**	$ 334.00	$ 1,336,000.00	$ 13,360.00	$ 1,349,360.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
5,000	6	$ 2.23	$ 66,900.00	$ 2,341.50	$ 69,241.50

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
-	-	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 1,418,601.50**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 425,580.45
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 1,864,181.95**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 111,850.92
4% Rate of Return on Investment of Unspent Funds	$ 37,283.64
Net Interest	**$ 74,567.28**
TOTAL CAPITAL COST	**$ 1,938,749.23**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 15,768.91

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	100	300	70%	2	0.06	$ 3,796.04

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 160,318.14**
WUG Total WMS Cost Per Acre-Foot	**$ 2,226.64**

NB. START CONSTRUCTION IN 2040, ADDITIONAL WATER IS NEEDED IN 2050

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF COMBINED CONSUMERS WATER SUPPLY CORPORATION IN HUNT COUNTY

Description of Water User Group:

Combined Consumers Water Supply Corporation is a public water supply located primarily in Hunt County and supplies consumers in both Hunt and Van Zandt counties. Approximately 80% of the WSC's consumer demand is located in Hunt County. Current water supply is from the Sabine River Authority (SRA) and Cash WSC. Approximately 94% of water supply to the WSC is from SRA. The WSC is projected to have a supply deficit of 75 ac-ft/yr in 2030 and increasing to a deficit of 3631 in 2060. Combined Consumers WSC will need a contract increase in order to supply this projected shortage. Normally, the WSC would request a contract increase from SRA, but the authority has allocated all Lake Tawakoni and Lake Fork water to its existing customers. SRA is proposing to transfer water from the Toledo Bend Reservoir to meet anticipated needs of its customers. Water from Toledo Bend will be used to meet Combined Consumers needs beginning in 2030. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	6999	8656	11048	15003	23844	37701
Projected Water Demand	902	1115	1423	1933	3072	4857
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	1419	1390	1348	1312	1271	1226
Projected Supply Surplus (+) / Deficit (-)	**517**	**275**	**-75**	**-621**	**-1801**	**-3631**

Evaluation of Potentially Feasible Water Management Strategies:

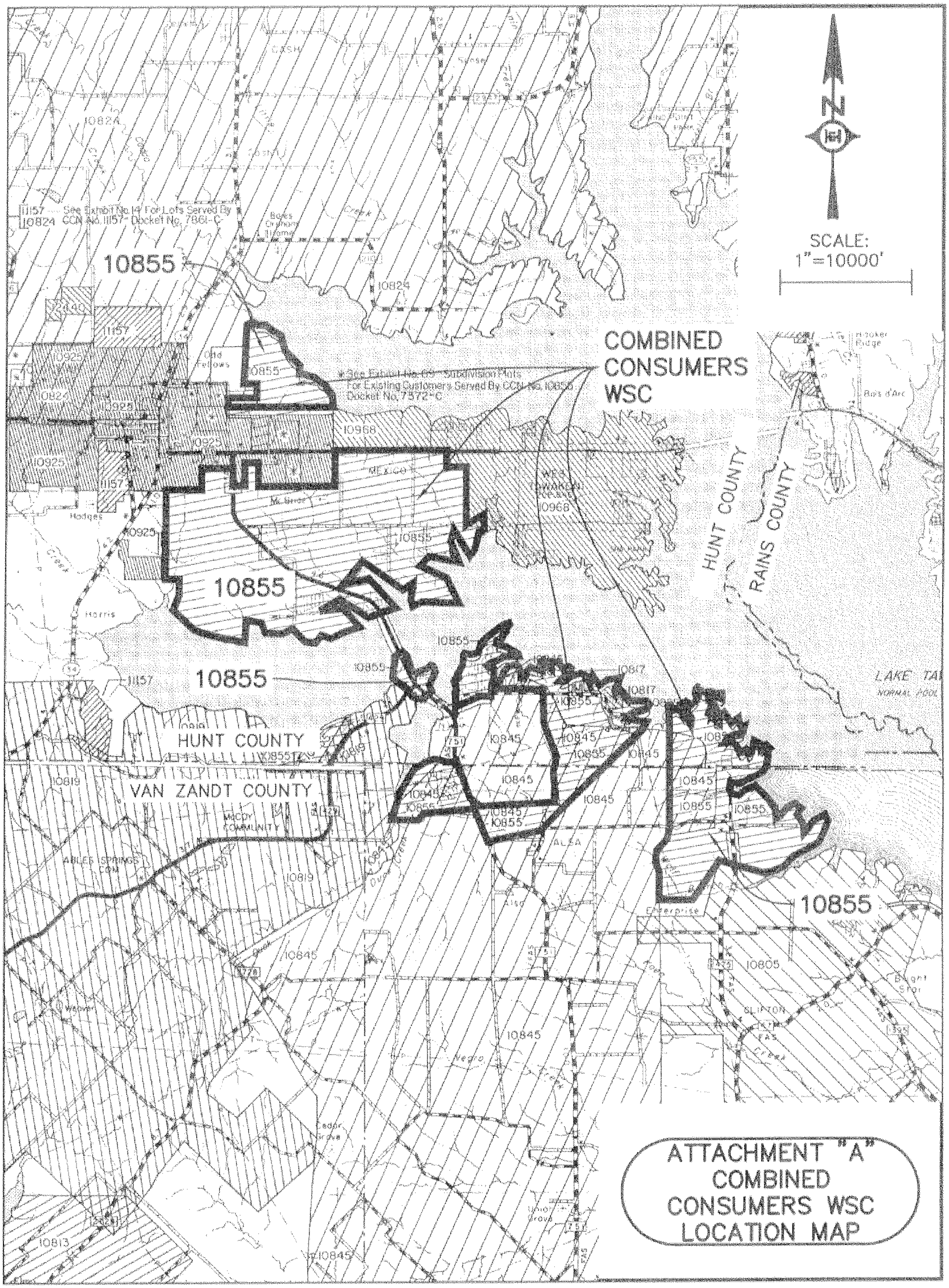
The four alternative strategies considered to meet Combined Consumers WSC's water supply shortages are listed in the table below. Advanced conservation was not selected since per capita use is less than 140 gpcpd. There are no significant current water needs that could be met by water reuse. Groundwater was not selected because it is inadequate in quality and quantity. Consequently, surface water was considered as a viable alternative to meet projected demands. Surface water worksheet is included as Attachment B.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**3631**	**-**	**$116,924**	**$114**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	**0**	**0**	**75**	**621**	**1801**	**3631**

The recommended strategy for Combined Consumers WSC to meet their projected deficit from 2030 is to purchase raw water from the Sabine River Authority's proposed Toledo Bend Transfer.


N
SCALE:
1"=10000'
COMBINED
CONSUMERS
WSC
11157 - See Exhibit No.14 For Lots Served By
10824 CCN No.11157 - Docket No. 7861-C
* See Exhibit No. 09 Subdivision Plats
For Existing Customers Served By CCN No. 10855
Docket No. 7572-C
10855
10824
10925
11157
10968
10845
10817
10819
10805
10813
HUNT COUNTY
RAINS COUNTY
VAN ZANDT COUNTY
LAKE TAWAKONI
MCCOY COMMUNITY
ATTACHMENT "A"
COMBINED
CONSUMERS WSC
LOCATION MAP

Attachment B - Purchased Supply Worksheet
Combined Consumers WSC
Hunt County

Water Purchase Contract With Sabine River Authority (proposed Toledo Bend tranfer):

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)	
3,241,548	**3631**	$ 0.83	Pre-Amortization 2010 to 2040
		$ 0.29	After Amortization 2050 to 2060

Pump Station

	Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
	-	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Ground Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost		**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)		**1.0**
Other Capital Costs		
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)		$ -
ENVIRONMENTAL (LUMP SUM)		$ -
Total Borrowed Funds		**$ -**
INTEREST DURING CONSTRUCTION(IDC):	6% Annual Interest on Total Borrowed Funds	$ -
	4% Rate of Return on Investment of Unspent Funds	$ -
	Net Interest	**$ -**
TOTAL CAPITAL COST		**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	75	621	1801	3631	1,021
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ 20,284.22	$ 167,953.38	$ 170,188.72	$ 343,117.84	$ 116,924.03
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ -**	**$ 20,284.22**	**$ 167,953.38**	**$ 170,188.72**	**$ 343,117.84**	**$ 116,924.03**

UNIT COST
($ / ac-ft / yr) **$ 114.48**

Attachment C						
Cost of Transferring Water from Toledo Bend to Upper Sabin Basin						
Owners:						
Amount-Toledo Bend (Total):		500000				
-SRA		100000				
-NTMWD		200000				
-TRWD		200000				
Segments:			**SRA**	**NTMWD**	**TRWD**	**Flow (Ac-ft)**
Toledo Bend to Longview		TB1	20%	40%	40%	500000
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		Size	**Quantity**	**Unit**	**Unit Price**	**Cost**
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Subtotal of Pump Station(s)						**$ 65,496,995**
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		Size	**Quantity**	**Unit**	**Unit Price**	**Cost**
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Permitting and Mitigation						$ 85,885
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Engineering and Contingencies (35%)						$ 3,460,060
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-NTMWD						$ 34,766,646
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Segments:		**SRA**	**NTMWD**		**TRWD**	**Flow (Ac-ft)**
Longview to Lake Fork	TB2	11%	44%		44%	450000
Construction Costs:						
-Transmission Facilities						
	Size	**Quantity**	**Unit**		**Unit Price**	**Cost**
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						$ 14,234,157
Engineering and Contingencies (35%)						$ 4,981,955
Subtotal of Pump Station(s)						**$ 19,216,112**
-Storage Tanks						
	Size	**Quantity**	**Unit**		**Unit Price**	**Cost**
Storage TB2	10MG	6	Ea	$	1,400,000	$ 8,400,000
Permitting and Mitigation						$ 73,615
						$ 8,473,615
Engineering and Contingencies (35%)						$ 2,965,765
Subtotal of Storage Tanks						**$ 11,439,381**
Construction Total						**$ 389,213,085**
Interest During Construction			(36 months)			**$ 46,705,570**
Total Cost						**$ 435,918,656**
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Debt Service(6% for 30 years)						
-SRA						$ 3,516,410
-NTMWD						$ 14,065,642
-TRWD						$ 14,065,642
Raw Water and Operating Costs						

Total							
-SRA							$ 1,937,416
-NTMWD							$ 7,749,665
-TRWD							$ 7,749,665
Total Annual Costs							
-SRA							$ 5,453,827
-NTMWD							$ 21,815,307
-TRWD							$ 21,815,307
Segments:			**SRA**	**NTMWD**	**TRWD**		**Flow (Ac-ft)**
Lake Fork to Tawakoni		A1	20%	0%	80%		250000
Construction Costs:							
-Transmission Facilities							
		Size	**Quantity**	**Unit**	**Unit Price**		**Cost**
Pipeline-A1		2-78 in.	142,040	LF	$ 364.00		$ 103,405,120
Right of Way Easements (rural)			1359	Acre	$ 3,000.00		$ 4,077,394
Permitting and Mitigation				LS			$ 7,464,675
							$ 114,947,189
Engineering and Contingencies (30%)							$ 34,484,157
Subtotal of Pipeline							**$ 149,431,346**
-Pump Station(s)							
-Storage Tanks							
Construction Total							**$ 149,431,346**
Interest During Construction				(36 months)			**$ 17,931,762**
Total Cost							**$ 167,363,107**
Total Cost by User							
-SRA							$ 33,472,621
-NTMWD							$ -
-TRWD							$ 133,890,486
Annual Cost Pre-Amortization							
Debt Service(6% for 30 years)							
-SRA							$ 2,430,112
-NTMWD							$ -
-TRWD							$ 9,720,449
Raw Water and Operating Costs							
Total							
-SRA							$ 1,338,905
-NTMWD							$ -
-TRWD							$ 5,355,619
Total Annual Costs							
-SRA							$ 3,769,017
-NTMWD							$ -
-TRWD							$ 15,076,069
Segments:							

Cost of Transferring Water from Toledo Bend to Upper Sabin Basin

Toledo Bend to Longview to Lake Fork to Lake Tawakoni		
Total Annual Cost Pre-Amortization		
-SRA	$	26,606,167
-NTMWD	$	56,581,953
-TRWD	$	71,658,022
Unit Cost Pre-Amortization		
Per Acre-Foot		
-SRA	$	266
-NTMWD	$	283
-TRWD	$	358
Per 1000 gallons		
-SRA	**$**	**0.83**
-NTMWD	$	0.88
-TRWD	$	1.11
Total Annual Cost After-Amortization		
-SRA	$	9,451,569
-NTMWD	$	20,100,161
-TRWD	$	25,455,780
Unit Cost After-Amortization		
Per Acre-Foot		
-SRA	$	95
-NTMWD	$	101
-TRWD	$	127
Per 1000 gallons		
-SRA	**$**	**0.29**
-NTMWD	$	0.31
-TRWD	$	0.40

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF HICKORY CREEK SUD IN HUNT COUNTY

Description of Water User Group:

Hickory Creek SUD is currently supplied by three wells in the Woodbine aquifer. All wells are located in Hunt County and have a total rated capacity of 690 gpm or 371 ac-ft/yr. Over 90% of the SUD's demand is located in Region D (Hunt County), with less than 10% in Region C (Collin and Fannin Counties). In both regions, the system is projected to serve a total of 2,567 people in 2010 and 12,923 people by the year 2060. The population and demand projections for the portion of the system in Hunt County are given in the table bellow. In Hunt County, Hickory Creek is projected to have a water supply deficit of 70 ac-ft/yr by 2010. The deficit is projected to increase to 1666 ac-ft/yr by 2060. The system does not have either a water conservation plan or a drought management plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	2323	2871	3664	4978	7910	12508
Projected Water Demand	395	479	600	808	1275	2017
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	325	325	329	334	344	351
Projected Supply Surplus (+) / Deficit (-)	**-70**	**-154**	**-271**	**-474**	**-931**	**-1666**

Evaluation of Potentially Feasible Water Management Strategies:

The four alternative strategies considered to meet Hickory Creek's water supply shortages are listed in the table below. Advanced conservation was considered because per capita use of 155 gpcpd is more than the 140 gpcpd set by the regional planning group. However, the projected savings is minimal in comparison to the predicted shortage. There are no significant current water needs in Hickory Creek that could be met by water reuse. No surface water alternatives were evaluated because the SUD advised that it would continue adding wells to meet future demands. Groundwater from the Woodbine Aquifer was considered since it is currently the source of supply for the system. A groundwater worksheet is included as Attachment B, and a water conservation worksheet as Attachment C.

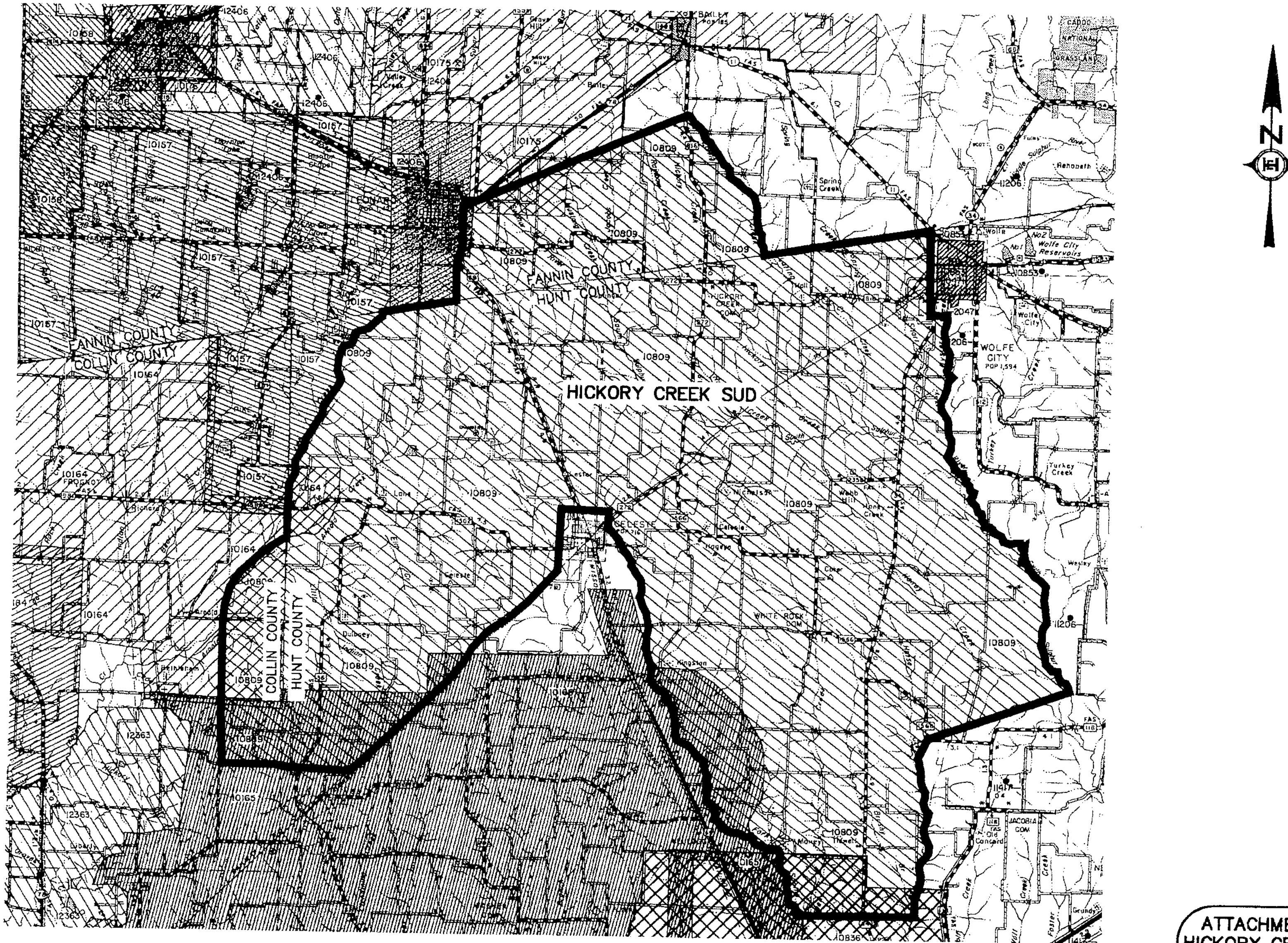
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation	**47**	**$312,396**	-	**$730**	**Minimal**
Water Reuse					
Ground Water	**1882**	**$6,880,290**	**$808,680**	**$909**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	269	269	269	538	1076	1882

Hickory Creek SUD has a documented plan to drill a well with a rated capacity of 500 gpm (269 ac-ft/yr) by June 2005 in the Woodbine Aquifer, Hunt County. The three existing wells plus this additional well have the capacity to meet projected demand up to 2030 in all three counties. Six or more additional wells will have to be drilled during successive decades to ensure that a deficit is not encountered by the SUD.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be re-evaluated.



ATTACHMENT "A"
HICKORY CREEK SUD
LOCATION MAP

Attachment B - Groundwater worksheet
Hickory Creek SUD
Hunt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
7	2000	500	**1882**	$ 334.00	$4,676,000.00	$ 46,760.00	$ 4,722,760.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
18,400	6	$ 2.23	$ 246,192.00	$ 8,616.72	$ 254,808.72

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
-		$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 4,977,568.72**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.5**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 1,493,270.62
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 6,490,839.34**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 584,175.54
4% Rate of Return on Investment of Unspent Funds	$ 194,725.18
Net Interest	**$ 389,450.36**
TOTAL CAPITAL COST	**$ 6,880,289.70**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 275,955.88

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	500	150	70%	7	0.06	$ 33,215.37

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 808,680.28**
WUG Total WMS Cost Per Acre-Foot	**$ 908.82**

Attachment C - Conservation Worksheet

Cost-Savings Analysis for Region D - Hickory Creek SUD

Regional Data	
Population	5,709
SF Population	5,709
MF Population	-
Institutional Population	-
SF Units	2,284
MF Units	-
Average Yearly Rainfall (inches)	41.6
SF Household Size	2.50
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	-
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit	10.5	26.3	2.0	13.1	10%	50%	-	-	-	$ -	$ -	$ -	free or rebate
SF Showerheads and Aerators	5.5	13.8	2.0	6.9	10%	50%	-	-	-	$ -	$ -	$ -	kits picked up by customer
SF Clothes Washer Rebate	5.6	14.0	1.0	14.0	0%	90%	2,055	28,773	32.23	$ 120	$ 246,629	$ 815	rebate from water utility only
SF Irrigation Audit-High User	20.0	50.0	1.0	50.0	1%	5%	91	4,567	5.12	$ 70	$ 6,394	$ 459	staff
SF Rainwater Harvesting	18.3	45.8	1.0	45.8	0%	5%	114	5,226	5.85	$ 250	$ 28,545	$ 470	rebate
SF Rain Barrels	2.0	5.0	1.0	5.0	0%	30%	685	3,395	3.80	$ 45	$ 30,829	$ 781	rebate or distribution
MF Toilet Retrofit													
MF Showerheads and Aerators													
MF Clothes Washer Rebate													
MF Irrigation Audit													
MF Rainwater Harvesting													
								41,962	47		$ 312,396	$730.23	
Commercial													
Commercial Toilet Retrofit													
Coin-Operated Clothes Washer Rebate													
Irrigation Audit													
Commercial General Rebate													
Commercial Rainwater Harvesting													

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF NORTH HUNT WATER SUPPLY CORPORATION IN HUNT COUNTY

Description of Water User Group:

North Hunt WSC provides water service in Hunt County, Fannin County and Delta County. It is projected that the users in Hunt County will have a shortage around 2020. In Hunt County, the WUG population is projected to be 2,631 in 2010 and 14,171 by the year 2060. The WSC has a contract for water supply with the City of Commerce for 147 ac-ft/yr, a well in Ladonia with a rating of 230 gpm, a well in Hunt county with a rating of 115 gpm , and a well in Fannin County that is rated at 350 gpm. In Hunt County, the WSC is projected to have a deficit of 70 ac-ft in 2020 and increasing to a deficit of 1444 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	2631	3253	4153	5639	8962	14171
Projected Water Demand	339	419	535	726	1154	1825
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	344	349	356	363	374	382
Projected Supply Surplus (+) / Deficit (-)	**5**	**-70**	**-179**	**-363**	**-780**	**-1444**

Evaluation of Potentially Feasible Water Management Strategies:

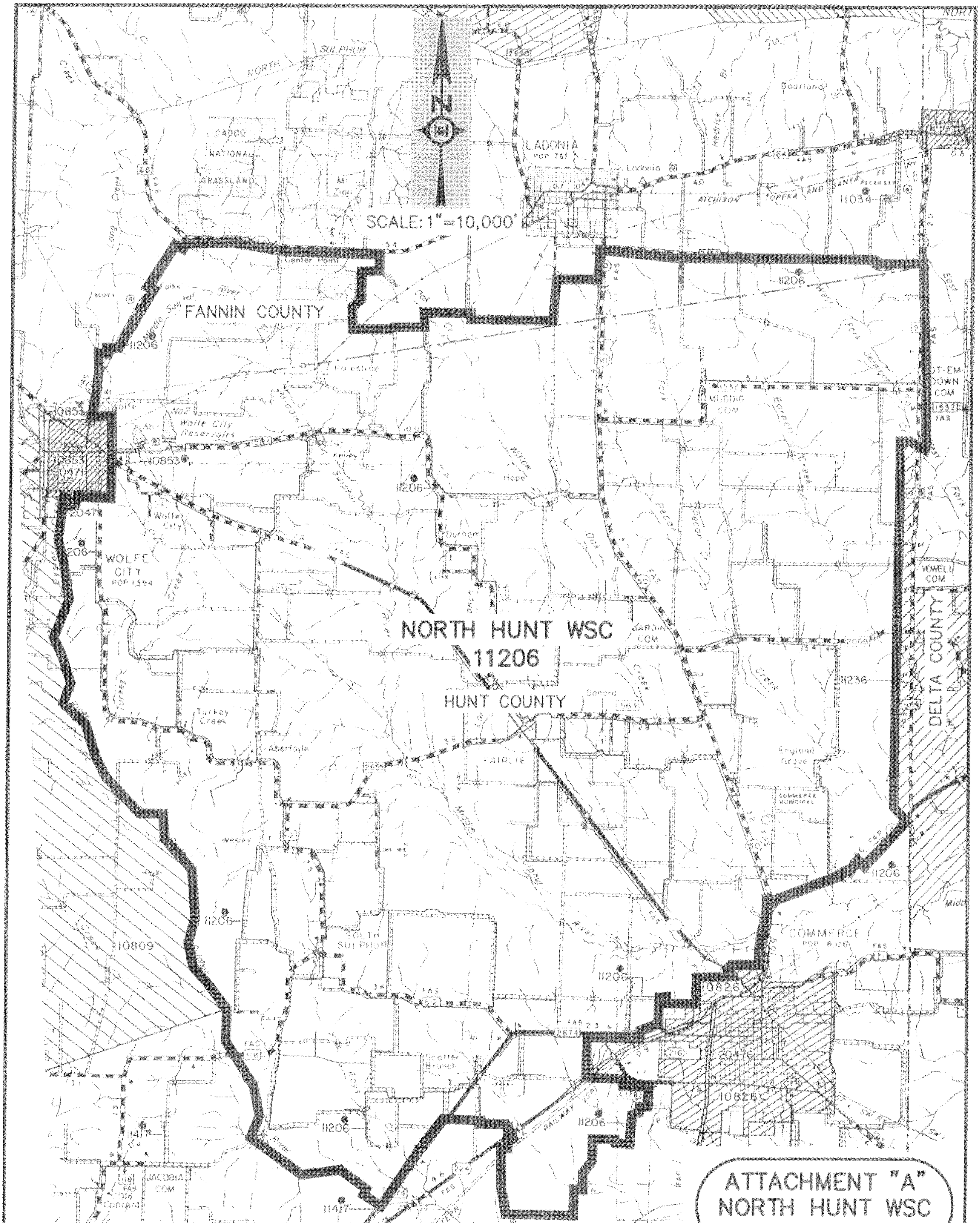
There were four alternative strategies considered to meet the WSC's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the WSC is planning on meeting its future needs from water purchase from the City of Commerce.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**1444**	**$0**	**$462,057**	**$978**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)		70	179	363	780	1444

Surface water purchase from City of Commerce is the recommended strategy to meet North Hunt WSC's needs.


SCALE: 1"=10,000'
N
LADONIA
FANNIN COUNTY
NORTH HUNT WSC
11206
HUNT COUNTY
WOLFE CITY
COMMERCE
DELTA COUNTY
NEYLANDVILLE
SOUTH SULPHUR
ATTACHMENT "A"
NORTH HUNT WSC
LOCATION MAP

Surface Water Worksheet
North Hunt WSC
Hunt County

Water Purchase Contract With City of Commerce:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
1,289,120	**1444.0**	$ 3.00

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	70	179	363	780	1444	473
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ 68,428.71	$ 174,981.99	$ 354,851.74	$ 762,491.34	$ 1,411,586.53	$ 462,056.72
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ 68,428.71**	**$ 174,981.99**	**$ 354,851.74**	**$ 762,491.34**	**$ 1,411,586.53**	**$ 462,056.72**

UNIT COST
($ / ac-ft / yr) **$ 977.55**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF STEAM ELECTRIC IN HUNT COUNTY

Description of Water User Group:

The Steam Electric WUG in Hunt County has a demand that is projected to grow from 8,639 ac-ft/yr in 2010 to 23,902 ac-ft/yr in 2060. This demand is projected as a result of a proposed Cobisa power plant near Greenville. Greenville currently contracts with the Sabine River Authority for its supply. All SRA water from Lake Tawakoni and Lake Fork has been contracted and there is no water available from these lakes to meet the projected steam electric demands. SRA is proposing to transfer water from the Toledo Bend Reservoir to the North Texas region to meet anticipated future needs of its customers. Since there is no other wholesale water provider in the area with adequate amounts of water to meet steam electric demands in Hunt County, SRA water from the Toledo Bend Reservoir will be used to meet future shortages.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Projected Water Demand	8639	12366	14457	17006	20114	23902
Current Water Supply	0	0	0	0	0	0
Projected Supply Surplus (+)/Deficit(-)	**-8639**	**-12366**	**-14457**	**-17006**	**-20114**	**-23902**

Evaluation of Potentially Feasible Water Management Strategies:

Three alternative strategies were considered to meet the Hunt County Steam Electric WUG's watersupply shortages. In this round of planning, estimates were not made for electric power water conservation because data on operating strategies for each power plant was not available. Groundwater is not feasible due to the limited capacity of aquifers in the Greenville area. Surface water was considered as a viable alternative to meet projected demands. A surface water purchase worksheet is included as Attachment A.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**23,902**	-	**$ 3,058,279**	**$ 190**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	**8639**	**12366**	**14457**	**17006**	**20114**	**23902**

The recommended strategy for the Hunt County Steam Electric WUG to meet projected demands during the planning period is to purchase raw water from the Sabine River Authority's proposed Toledo Bend transfer.

Attachment A - Surface Water worksheet
Steam Electric
Hunt County

Water Purchase from Sabine River Authority (Supply from proposed Toledo Bend transfer) :

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)	
21,338,330	**23902**	$ 0.83	Pre-Amortization 2010 to 2040
		$ 0.29	After Amortization 2050 to 2060

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	8639	12366	14457	17006	20114	23902	16,081
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 2,336,472.23	$ 3,344,462.98	$ 3,909,987.16	$ 4,599,380.35	$ 1,900,708.43	$ 2,258,662.27	$ 3,058,278.91
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 2,336,472.23**	**$ 3,344,462.98**	**$ 3,909,987.16**	**$ 4,599,380.35**	**$ 1,900,708.43**	**$ 2,258,662.27**	**$ 3,058,278.91**

UNIT COST
($ / ac-ft / yr)

$ 190.18

Attachment B						
Cost of Transferring Water from Toledo Bend to Upper Sabin Basin						
Owners:						
Amount-Toledo Bend (Total):		500000				
-SRA		100000				
-NTMWD		200000				
-TRWD		200000				
Segments:			**SRA**	**NTMWD**	**TRWD**	**Flow (Ac-ft)**
Toledo Bend to Longview		TB1	20%	40%	40%	500000
Construction Costs:						
-Transmission Facilities						
		Size	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline-TB1		2-108 in.	366,400	LF	$ 633.00	$ 463,862,400
Right of Way Easements (rural)			665	Acre	$ 3,000.00	$ 1,993,963
Permitting and Mitigation				LS		$ 3,650,442
						$ 469,506,805
Engineering and Contingencies (30%)						$ 140,852,042
Subtotal of Pipeline						**$ 610,358,847**
-Pump Station(s)						
Intake and Pump Station - TB1				HP		$ 27,660,000
Booster Pump Station - TB1				HP		$ 20,500,000
Permitting and Mitigation						$ 356,292
						$ 48,516,292
Engineering and Contingencies (35%)						$ 16,980,702
Subtotal of Pump Station(s)						**$ 65,496,995**
-Storage Tanks						
		Size	**Quantity**	**Unit**	**Unit Price**	**Cost**
Storage TB1		10MG	7	Ea	$ 1,400,000	$ 9,800,000
Permitting and Mitigation						$ 85,885
						$ 9,885,885
Engineering and Contingencies (35%)						$ 3,460,060
Subtotal of Storage Tanks						**$ 13,345,944**
Construction Total						**$ 689,201,786**
Interest During Construction				(36 months)		**$ 82,704,214**
Total Cost						**$ 771,906,000**
Total Cost by User						
-SRA						$ 154,381,200
-NTMWD						$ 308,762,400
-TRWD						$ 308,762,400
Annual Cost Pre-Amortization						
Debt Service(6% for 30 years)						
-SRA						$ 11,208,075
-NTMWD						$ 22,416,150
-TRWD						$ 22,416,150
Raw Water and Operating Costs						

Cost of Transferring Water from Toledo Bend to Upper Sabin Basin

Total						
-SRA						$ 6,175,248
-NTMWD						$ 12,350,496
-TRWD						$ 12,350,496
Total Annual Costs						
-SRA						$ 17,383,323
-NTMWD						$ 34,766,646
-TRWD						$ 34,766,646
Segments:		**SRA**	**NTMWD**	**TRWD**		**Flow (Ac-ft)**
Longview to Lake Fork	TB2	11%	44%	44%		450000
Construction Costs:						
-Transmission Facilities						
	Size	**Quantity**	**Unit**	**Unit Price**		**Cost**
Pipeline-TB2	2-102 in.	240,800	LF	$	565.00	$ 272,104,000
Right of Way Easements (rural)		437	Acre	$	3,000.00	$ 1,310,443
Permitting and Mitigation			LS			$ 2,399,089
						$ 275,813,533
Engineering and Contingencies (30%)						$ 82,744,060
Subtotal of Pipeline						**$ 358,557,592**
-Pump Station(s)						
Booster Pump Station - TB2			HP			$ 14,000,000
Permitting and Mitigation						$ 234,157
						$ 14,234,157
Engineering and Contingencies (35%)						$ 4,981,955
Subtotal of Pump Station(s)						**$ 19,216,112**
-Storage Tanks						
	Size	**Quantity**	**Unit**	**Unit Price**		**Cost**
Storage TB2	10MG	6	Ea	$	1,400,000	$ 8,400,000
Permitting and Mitigation						$ 73,615
						$ 8,473,615
Engineering and Contingencies (35%)						$ 2,965,765
Subtotal of Storage Tanks						**$ 11,439,381**
Construction Total						**$ 389,213,085**
Interest During Construction			(36 months)			**$ 46,705,570**
Total Cost						**$ 435,918,656**
Total Cost by User						
-SRA						$ 48,435,406
-NTMWD						$ 193,741,625
-TRWD						$ 193,741,625
Annual Cost Pre-Amortization						
Debt Service(6% for 30 years)						
-SRA						$ 3,516,410
-NTMWD						$ 14,065,642
-TRWD						$ 14,065,642
Raw Water and Operating Costs						

Cost of Transferring Water from Toledo Bend to Upper Sabin Basin

Total						
-SRA						$ 1,937,416
-NTMWD						$ 7,749,665
-TRWD						$ 7,749,665
Total Annual Costs						
-SRA						$ 5,453,827
-NTMWD						$ 21,815,307
-TRWD						$ 21,815,307

Segments:		**SRA**	**NTMWD**	**TRWD**		**Flow (Ac-ft)**
Lake Fork to Tawakoni	A1	20%	0%	80%		250000
Construction Costs:						
-Transmission Facilities						
	Size	**Quantity**	**Unit**	**Unit Price**		**Cost**
Pipeline-A1	2-78 in.	142,040	LF	$ 364.00		$ 103,405,120
Right of Way Easements (rural)		1359	Acre	$ 3,000.00		$ 4,077,394
Permitting and Mitigation			LS			$ 7,464,675
						$ 114,947,189
Engineering and Contingencies (30%)						$ 34,484,157
Subtotal of Pipeline						**$ 149,431,346**
-Pump Station(s)						
-Storage Tanks						
Construction Total						**$ 149,431,346**
Interest During Construction			(36 months)			**$ 17,931,762**
Total Cost						**$ 167,363,107**
Total Cost by User						
-SRA						$ 33,472,621
-NTMWD						$ -
-TRWD						$ 133,890,486
Annual Cost Pre-Amortization						
Debt Service(6% for 30 years)						
-SRA						$ 2,430,112
-NTMWD						$ -
-TRWD						$ 9,720,449
Raw Water and Operating Costs						
Total						
-SRA						$ 1,338,905
-NTMWD						$ -
-TRWD						$ 5,355,619
Total Annual Costs						
-SRA						$ 3,769,017
-NTMWD						$ -
-TRWD						$ 15,076,069

Segments:						

Cost of Transferring Water from Toledo Bend to Upper Sabin Basin

Toledo Bend to Longview to Lake Fork to Lake Tawakoni		
Total Annual Cost Pre-Amortization		
-SRA	$	26,606,167
-NTMWD	$	56,581,953
-TRWD	$	71,658,022
Unit Cost Pre-Amortization		
Per Acre-Foot		
-SRA	$	266
-NTMWD	$	283
-TRWD	$	358
Per 1000 gallons		
-SRA	**$**	**0.83**
-NTMWD	$	0.88
-TRWD	$	1.11
Total Annual Cost After-Amortization		
-SRA	$	9,451,569
-NTMWD	$	20,100,161
-TRWD	$	25,455,780
Unit Cost After-Amortization		
Per Acre-Foot		
-SRA	$	95
-NTMWD	$	101
-TRWD	$	127
Per 1000 gallons		
-SRA	**$**	**0.29**
-NTMWD	$	0.31
-TRWD	$	0.40

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF THE CITY OF WOLFE CITY

Description of Water User Group:

The City of Wolfe City is located in northern Hunt County, and is situated in the Sulphur River Basin. Wolfe City is bound on the west side by the Hickory Creek SUD, and the City of Commerce is located southeast of the City. The system is projected to serve 1598 people by 2010, and the population is expected to increase to 2446 by the year 2060. Wolfe City's current source of supply comes from two city lakes located on Turkey Creek in the South Sulphur River Basin. The City also has a 150 gpm well in the Woodbine formation. which is not currently used because the well is in poor condition. Safe yield from the local lakes is estimated as 140 ac-ft/yr up to 2020 and then reducing to 120 ac-ft/yr thereafter. Based on this yields, water quantity from the lakes will not be sufficient to meet projected demands. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	1598	1649	1718	1828	2070	2446
Projected Water Demand	206	212	221	235	267	315
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	140	140	120	120	120	120
Projected Supply Surplus (+) / Deficit (-)	**-66**	**-72**	**-101**	**-115**	**-147**	**-195**

Evaluation of Potentially Feasible Water Management Strategies:

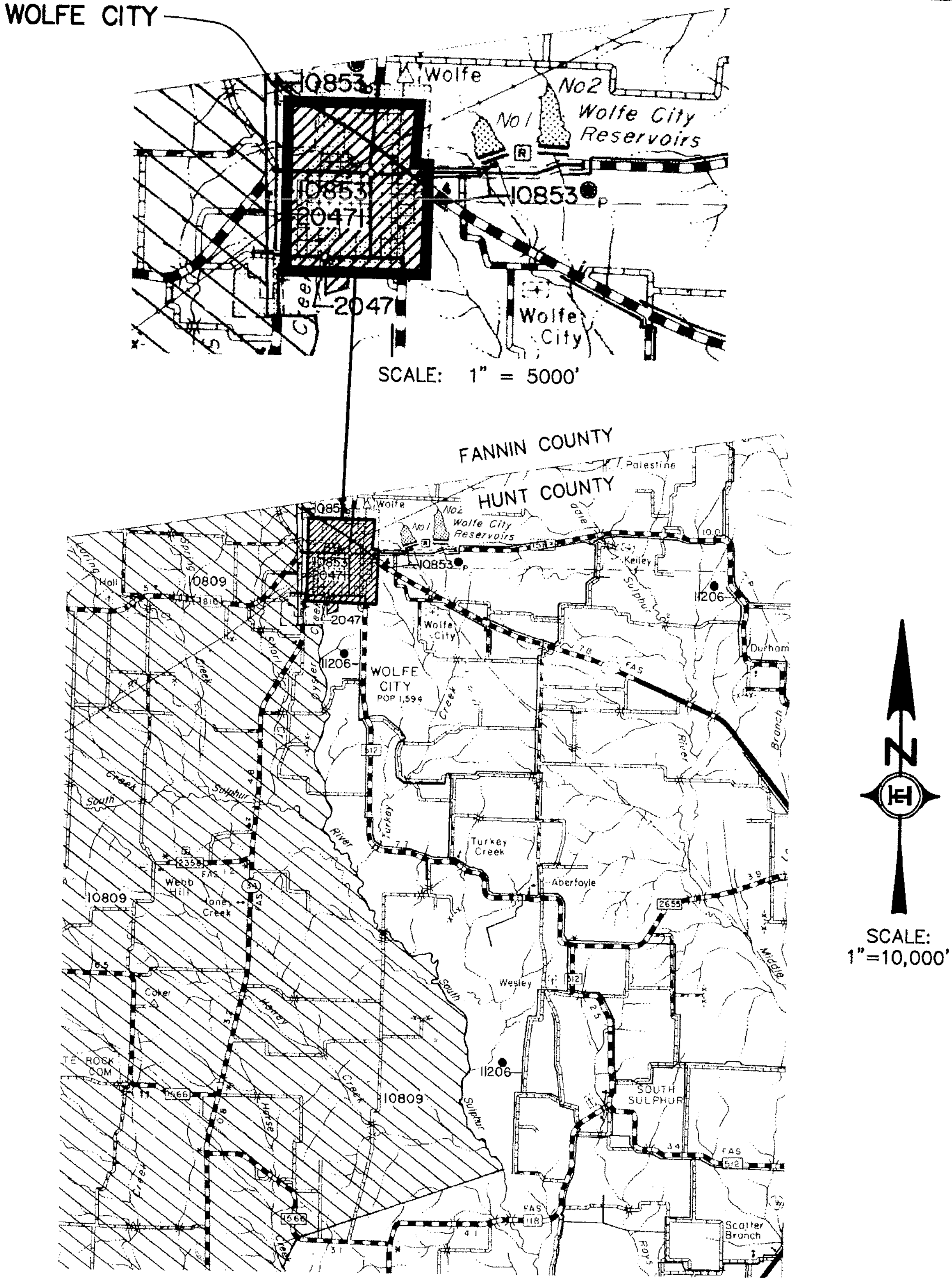
Listed in the table below are the four strategies that were considered to meet water supply needs in Wolfe City. There are no significant current water needs that could be met by water reuse. Advanced conservation was not selected since per capita use is less than 140 gpcpd. The system has a number of surface water options, including connection to the City of Commerce, City of Greenville, and the proposed Ralph Hall Reservoir in Region C. Groundwater is also an alternative for this entity. A groundwater worksheet is included as Attachment B, and a surface water purchase worksheet as Attachment C.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**242**	**$3,580,323**	**$303,953**	**$1,500**	**Minimal**
Surface Water	**195**	**$2,217,949**	**$193,908**	**$1,672**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	66	72	101	115	147	195

The capital cost of well construction is much higher than that of surface water purchase, while the unit cost of groundwater is slightly lower than that of surface water strategy. Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues, it is recommended that Wolf City purchase treated surface water from the City of Commerce. This recommendation is made based on limited knowledge of firm yield of the Wolf City lakes. No in-depth studies were available indicating either the current firm yield of the reservoirs, or whether dredging or similar enhancements to the storage capacity could improve the firm yield. It is recommended that the City pursue such a study. The City currently operates its own surface water treatment to treat water from the existing local lakes.



ATTACHMENT "A"
WOLFE CITY
LOCATION MAP

Attachment B - Groundwater worksheet
City of Wolf City
Hunt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
3	1750	150	**242**	$ 334.00	$ 1,753,500.00	$ 17,535.00	$ 1,771,035.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
36,960	8	$ 1.67	$ 493,785.60	$ 17,282.50	$ 511,068.10

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
1	300,000	$ 0.56	$ 168,000.00	$ 1,680.00	$ 169,680.00

Pump Station

No of Stations	Size MGD	Cost per station	Total Constr	Land & Easements	Subtotal
1	0.432	$ 176,000.00	$ 176,000.00	$ 5,000.00	$ 181,000.00

Total Construction Cost	**$ 2,632,783.10**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 789,834.93
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 3,442,618.02**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 206,557.08
4% Rate of Return on Investment of Unspent Funds	$ 68,852.36
Net Interest	**$ 137,704.72**
TOTAL CAPITAL COST	**$ 3,580,322.75**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 35,480.04

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	150	300	70%	3	0.06	$ 8,541.09

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 303,952.57**
WUG Total WMS Cost Per Acre-Foot	**$ 1,499.89**

Attachment C - Purchased Supply Worksheet
Wolfe City
Hunt County

Water Purchase Contract With City of Commerce:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
174,085	**195.0**	$ 3.00

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
1	$ 176,000.00	$ 176,000.00	$ 1,760.00	$ 177,760.00

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
73,920	10	$ 1.67	$ 1,234,464.00	$ 43,206.24	$ 1,277,670.24

Ground Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
1	300000	$ 0.56	$ 168,000.00	$ 1,680.00	$ 169,680.00

Total Construction Cost	**$ 1,625,110.24**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 487,533.07
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 2,132,643.31**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 127,958.60
4% Rate of Return on Investment of Unspent Funds	$ 42,652.87
Net Interest	**$ 85,305.73**
TOTAL CAPITAL COST	**$ 2,217,949.04**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	66	72	101	115	147	195	116
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 64,518.50	$ 70,383.82	$ 98,732.85	$ 112,418.60	$ 143,700.29	$ 190,622.84	$ 113,396.15
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 225,541.60**	**$ 231,406.92**	**$ 259,755.95**	**$ 112,418.60**	**$ 143,700.29**	**$ 190,622.84**	**$ 193,907.70**

UNIT COST
($ / ac-ft / yr) **$ 1,671.62**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF JACOBIA WATER SUPPLY CORPORATION IN HUNT COUNTY

Description of Water User Group:

Jacobia WSC provides water service in Hunt County. The WUG population is projected to be 957 in 2010 and 5,153 in the year 2060. The WSC has a contract for water supply with the City of Greenville for 336 ac-ft/yr. The WSC is projected to have a deficit of 84 ac-ft in 2050 and increasing to a deficit of 328 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	957	1183	1510	2051	3259	5153
Projected Water Demand	124	152	195	264	420	664
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	336	336	336	336	336	336
Projected Supply Surplus (+) / Deficit (-)	**212**	**184**	**142**	**72**	**-84**	**-328**

Evaluation of Potentially Feasible Water Management Strategies:

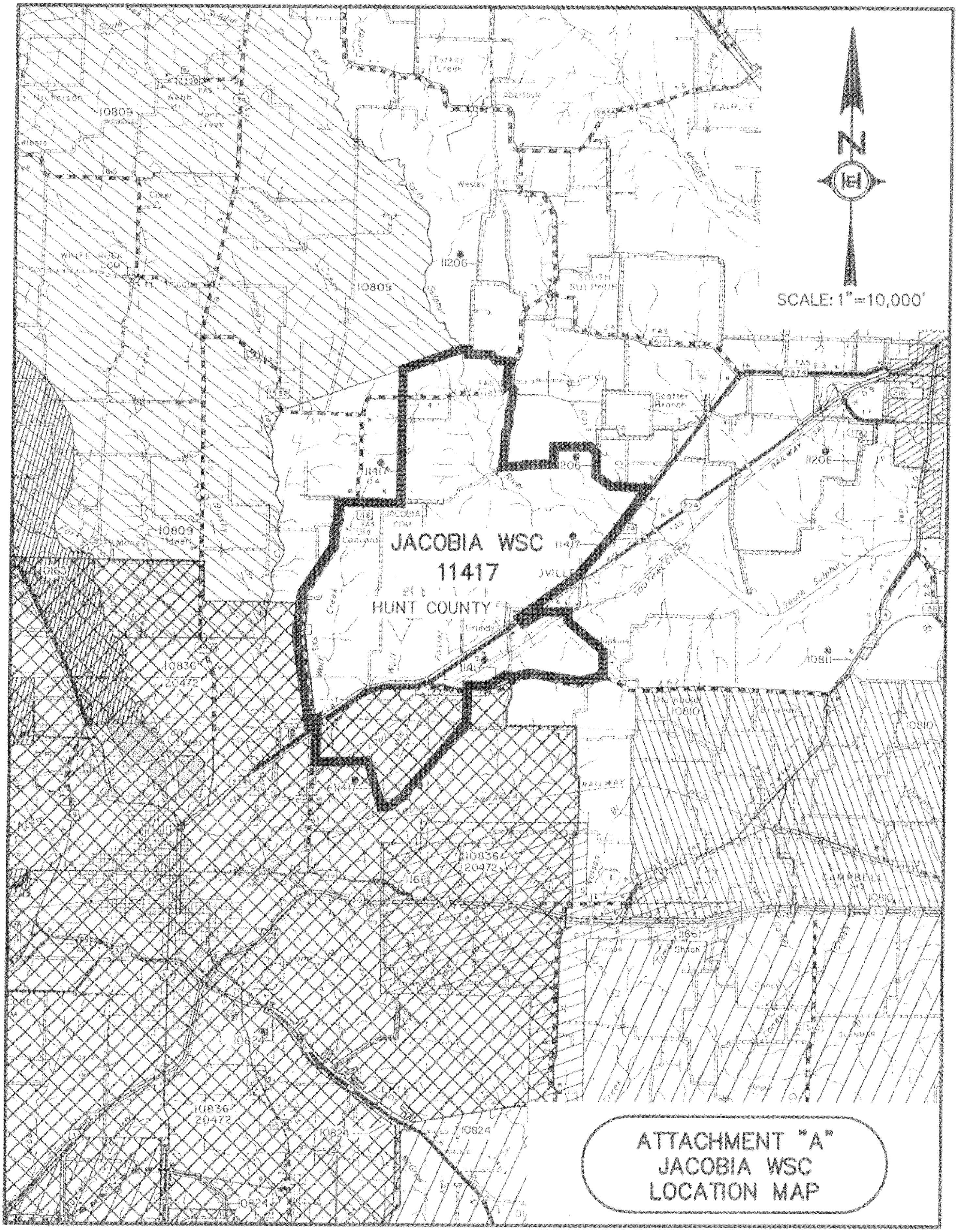
There were four alternative strategies considered to meet the WSC's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the WSC is planning on continuing to purchase surface water from the City of Greenville.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**328**	**$0**	**$67,125**	**$978**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)					84	328

Surface water purchase from City of Greenville is the recommended strategy to meet Jacobia WSC's needs.



ATTACHMENT "A"
JACOBIA WSC
LOCATION MAP

Surface Water Worksheet
Jacobia WSC
Hunt County

Water Purchase Contract With City of Greenville:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
292,820	**328.0**	$ 3.00

Pump Station

	Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
	0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	0	0	84	328	69
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ -	$ -	$ 82,114.45	$ 320,637.38	$ 67,125.31
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ -**	**$ -**	**$ -**	**$ 82,114.45**	**$ 320,637.38**	**$ 67,125.31**

UNIT COST
($ / ac-ft / yr) **$ 977.55**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF LITTLE CREEK ACRES

Description of Water User Group:

Little Creek Acres, which is within the County Other systems in Hunt County, is a small water supply system located in southern Hunt County. The population served is projected to be 236 persons in 2010 and increasing to 1272 persons in 2060. Current source of supply for the system is a well into the Nacatoch aquifer with a total rated capacity of 20 gpm, which equates to 11 ac-ft/yr on an annual average basis. Little Creek Acres is projected to have a water supply deficit of 20 ac-ft/yr beginning 2010 and increasing to a deficit of 153 ac-ft/yr by 2060.

Water Supply and Demand Analysis:

	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Population	236	292	373	506	804	1272
Projected Water Demand	31	38	48	65	104	165
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	11	11	11	11	11	11
Projected Supply Surplus (+) / Deficit (-)	**-20**	**-27**	**-37**	**-54**	**-93**	**-153**

Evaluation of Potentially Feasible Water Management Strategies:

The four alternative strategies considered to meet Little Creek Acres's water supply shortages are listed in the table below. Advanced conservation was not selected since per capita water use is less than 140 gallons per capita per day. Reuse is not a feasible option because there is no centralized wastewater collection system. Existing wells into the Nacatoch Aquifer have a very small capacity of 20 gpm and it would require approximately 15 wells to meet the shortage in 2060. Little Creek Acres is very small geographically and it would not be feasible to drill this many wells within the existing area. Consequently, groundwater is not a suitable alternative to meet Little Creek Acres needs. The system is surrounded by Cash WSC, and a purchased water alternative from Cash was also considered. A surface water purchase worksheet is included as Attachment B.

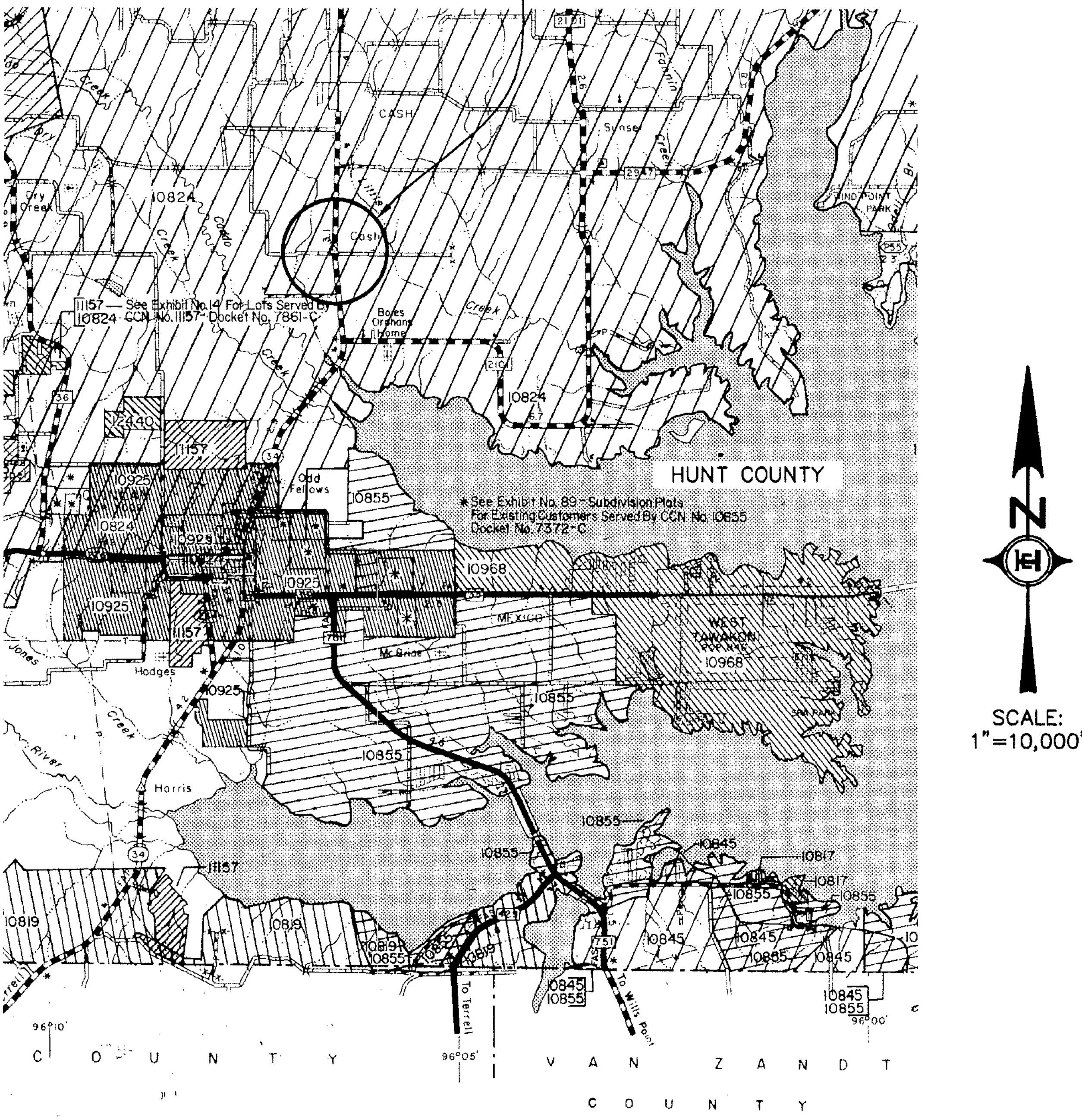
Strategy	**Firm Yield (ac-ft)**	**Total Capital Cost**	**Total Annual Cost**	**Unit Cost**	**Environmental Impact**
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**153**	**$100,670**	**$87,072**	**$1,360**	**Minimal**

Recommendations:

	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Surface Water (ac-ft/yr)	20	27	37	54	93	153

Purchase of treated surface water from Cash WSC is the recommended strategy that is cost effective and reliable for Little Creek Acres to meet the deficit beginning in 2010. A supply of 20 ac-ft/yr in 2010 and increasing to 153 ac-ft/yr in 2060 should be adequate to meet estimated demand. Little Creek Acres has total water storage of 0.004 MG. This storage does not meet the TCEQ's total storage requirement of 200 gallons/connection and will not be adequate for the projected growth of the system. The cost of constructing additional ground storage is included in the water purchase worksheet.

LITTLE CREEK ACRES
(CCN #11167)



ATTACHMENT "A"
LITTLE CREEK ACRES
LOCATION MAP

Attachment C - Purchased Supply Worksheet
Little Creek Acres
Hunt County

Water Purchase Contract With Cash WSC:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
136,590	**153.0**	$ 4.00

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
1,000	8	$ 1.67	$ 13,360.00	$ 467.60	$ 13,827.60

Ground Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
1	80000	$ 0.56	$ 44,800.00	$ 448.00	$ 45,248.00

Total Construction Cost	**$ 59,075.60**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 17,722.68
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 96,798.28**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 5,807.90
4% Rate of Return on Investment of Unspent Funds	$ 1,935.97
Net Interest	**$ 3,871.93**
TOTAL CAPITAL COST	**$ 100,670.21**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	20	27	37	54	93	153	64
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 26,068.08	$ 35,191.91	$ 48,225.95	$ 70,383.82	$ 121,216.57	$ 199,420.81	$ 83,417.86
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 33,376.74**	**$ 42,500.57**	**$ 55,534.61**	**$ 70,383.82**	**$ 121,216.57**	**$ 199,420.81**	**$ 87,072.18**

UNIT COST
($ / ac-ft / yr) **$ 1,360.50**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF MALOY WATER SUPPLY CORPORATION IN HUNT COUNTY

Description of Water User Group:

Maloy WSC provides water service in Hunt County. The WUG population is projected to be 427 in 2010 and 2,299 in the year 2060. The WSC has a contract for water supply with the City of Commerce for 34 ac-ft/yr. The WSC is projected to have a deficit of 26 ac-ft in 2010 and increasing to a deficit of 263 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	427	528	674	915	1454	2299
Projected Water Demand	59	73	91	118	188	297
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	34	34	34	34	34	34
Projected Supply Surplus (+) / Deficit (-)	**-26**	**-39**	**-57**	**-84**	**-154**	**-263**

Evaluation of Potentially Feasible Water Management Strategies:

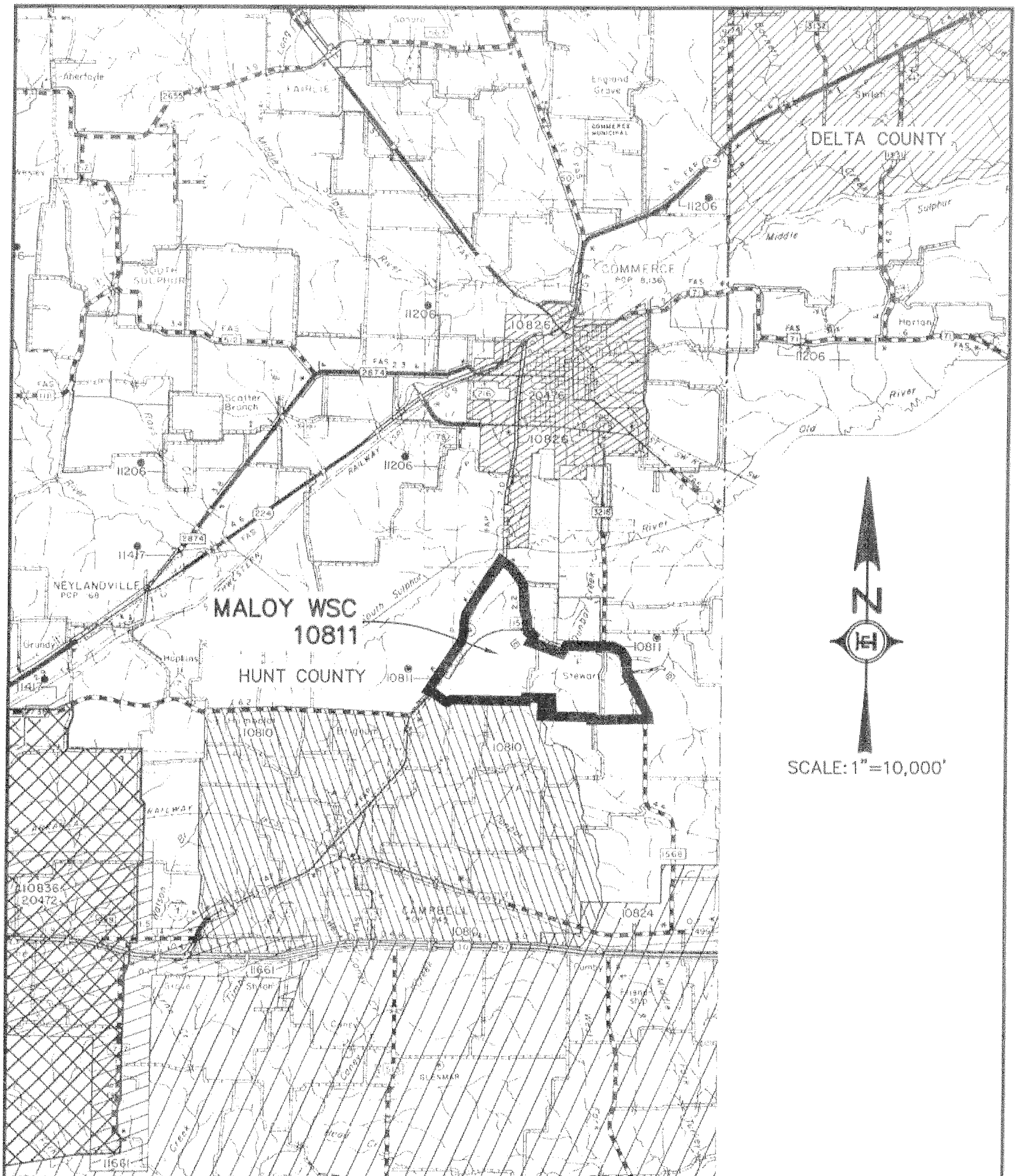
There were four alternative strategies considered to meet Maloy WSC's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the WSC is planning on continuing to purchase surface water from the City of Commerce.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**263**	**$0**	**$101,503**	**$978**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	26	39	57	84	154	263

Surface water purchase from City of Commerce is the recommended strategy to meet Maloy WSC's needs.



ATTACHMENT "A"
MALOY WSC
LOCATION MAP

Surface Water Worksheet
Maloy WSC
Hunt County

Water Purchase Contract With City of Commerce:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
234,791	**263.0**	$ 3.00

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	26	39	57	84	154	263	104
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 25,416.38	$ 38,124.57	$ 55,720.52	$ 82,114.45	$ 150,543.16	$ 257,096.44	$ 101,502.59
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 25,416.38**	**$ 38,124.57**	**$ 55,720.52**	**$ 82,114.45**	**$ 150,543.16**	**$ 257,096.44**	**$ 101,502.59**

UNIT COST
($ / ac-ft / yr) **$ 977.55**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF POETRY WATER SUPPLY CORPORATION IN HUNT COUNTY

Description of Water User Group:

Poetry WSC provides water service in Hunt County and Kaufman County. In Hunt County, the WUG population is projected to be 333 in 2010 and 1794 in the year 2060. The WSC has a contract for water supply with the City of Terrell, and the supplies available to portion of Poetry WSC in Hunt County are given in the table bellow. In Hunt County, the WSC is projected to have a deficit of 1 ac-ft in 2040 and increasing to a deficit of 46 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	333	412	526	714	1134	1794
Projected Water Demand	43	53	68	92	146	231
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	66	68	75	91	132	185
Projected Supply Surplus (+) / Deficit (-)	**23**	**15**	7	**-1**	**-14**	**-46**

Evaluation of Potentially Feasible Water Management Strategies:

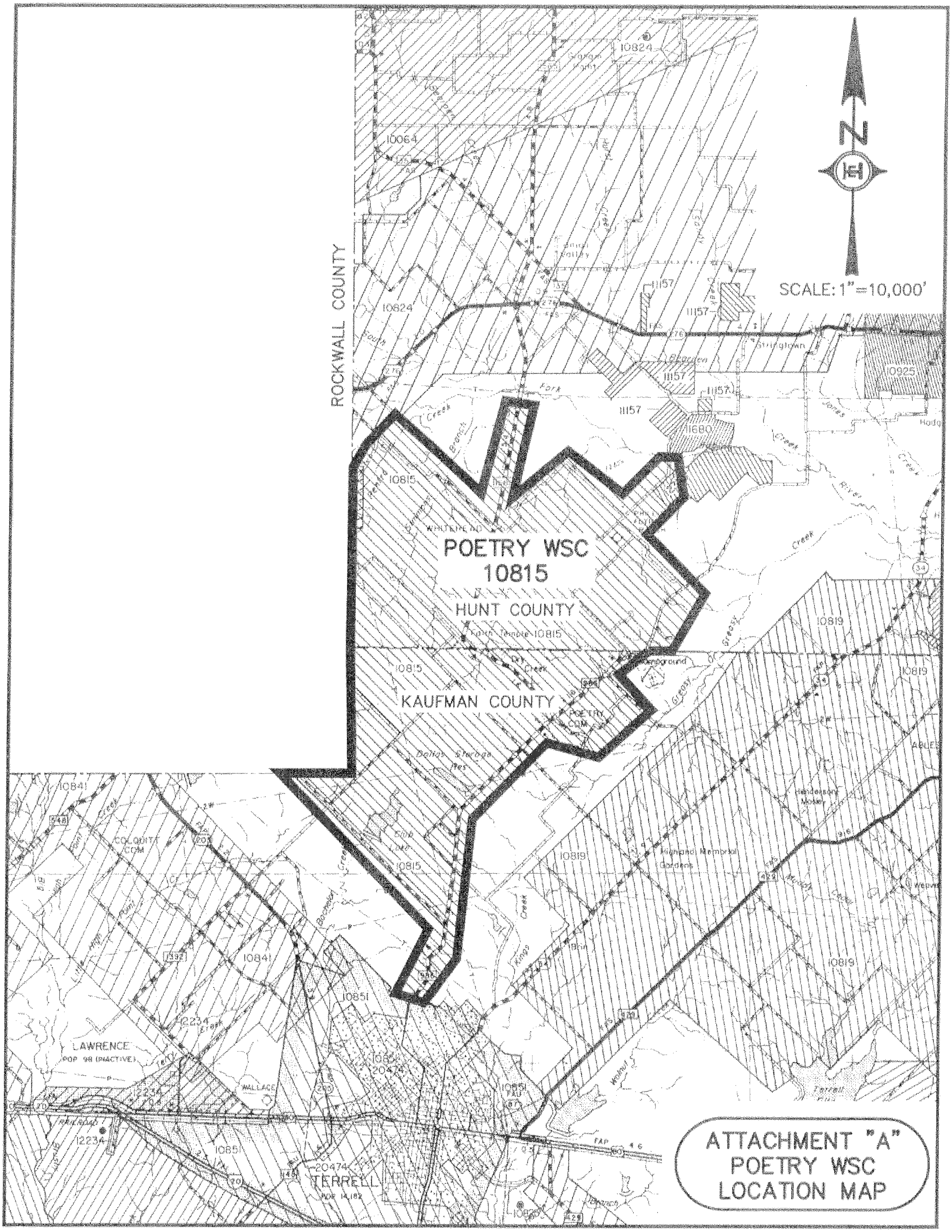
There were four alternative strategies considered to meet Poetry WSC's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the WSC is planning on continuing to purchase surface water from the City of Terrell.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**46**	**$0**	**$7,288**	**$717**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)				1	14	46

Surface water purchase from City of Terrell is the recommended strategy to meet Poetry WSC's needs.



ATTACHMENT "A"
POETRY WSC
LOCATION MAP

Surface Water Worksheet
Poetry WSC
Hunt County

Water Purchase Contract With City of Terrell:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
41,066	**46.0**	$ 2.20

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	0	1	14	46	10
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ -	$ 716.87	$ 10,036.21	$ 32,976.12	$ 7,288.20
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ -**	**$ -**	**$ 716.87**	**$ 10,036.21**	**$ 32,976.12**	**$ 7,288.20**

UNIT COST
($ / ac-ft / yr) **$ 716.87**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF SHADY GROVE WATER SUPPLY CORPORATION IN HUNT COUNTY

Description of Water User Group:

Shady Grove WSC provides water service in Hunt County. The WUG population is projected to be 1,211 in 2010 and 6,523 in the year 2060. The WSC has a contract for water supply with the City of Greenville for 560 ac-ft/yr. The WSC is projected to have a deficit of 280 ac-ft in 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	1211	1498	1911	2596	4125	6523
Projected Water Demand	157	193	246	334	531	840
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	560	560	560	560	560	560
Projected Supply Surplus (+) / Deficit (-)	**403**	**367**	**314**	**226**	**29**	**-280**

Evaluation of Potentially Feasible Water Management Strategies:

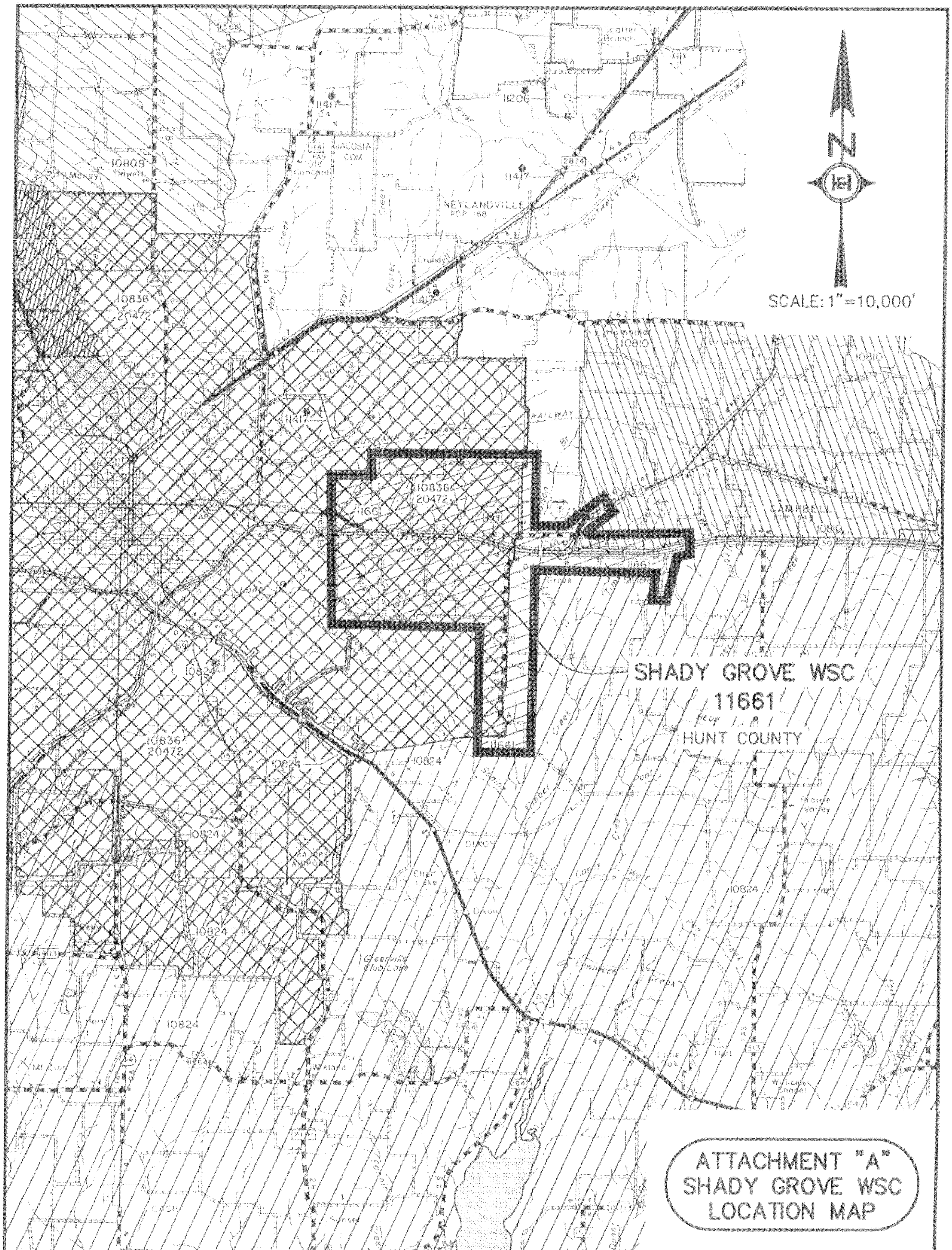
There were four alternative strategies considered to meet Shady Grove WSC's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was less than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the WSC is planning on continuing to purchase surface water from the City of Greenville.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**280**	**$0**	**$45,619**	**$978**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)						280

Surface water purchase from City of Greenville is the recommended strategy to meet Shady Grove WSC's needs.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N
SHADY GROVE WSC
11661
HUNT COUNTY
NEYLANDVILLE
CAMPBELL
10809
10836
20472
10810
10824
11661
11417
11206
JACOBIA
ATTACHMENT "A"
SHADY GROVE WSC
LOCATION MAP

Surface Water Worksheet
Shady Grove WSC
Hunt County

Water Purchase Contract With City of Greenville:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
249,968	**280.0**	$ 3.00

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	0	0	0	280	47
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ -	$ -	$ -	$ 273,714.84	$ 45,619.14
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 273,714.84**	**$ 45,619.14**

UNIT COST
($ / ac-ft / yr) **$ 977.55**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF WEST LEONARD WATER SUPPLY CORPORATION IN HUNT COUNTY

Description of Water User Group:

West Leonard WSC, which is within the County Other systems in Fannin County, supplies water to users in Collin, Fannin and Hunt counties. Currently, the WSC serves a total population of approximately 1300 people. Over 90% of the population is located in Fannin County. The paragraphs below describe the needs of the 3% population served in Hunt County. The population served is projected to be 45 persons in 2010 and increasing to 245 persons in 2060. Current source of supply for the system is a well into the Woodbine aquifer with a total rated capacity of 310 gpm, which equates to 167 ac-ft/yr on an annual average basis. 5 ac-ft/yr or 3% of the total supply is the water allocated to users in Hunt County. A water supply deficit of 2 ac-ft/yr beginning 2010 and increasing to a deficit of 28 ac-ft/yr by 2060 is projected for Hunt County. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	45	56	72	97	155	245
Projected Water Demand	7	8	10	14	21	33
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	5	5	5	5	5	5
Projected Supply Surplus (+) / Deficit (-)	**-2**	**-3**	**-5**	**-9**	**-16**	**-28**

Evaluation of Potentially Feasible Water Management Strategies:

Advanced conservation was not selected for West Leonard since per capita water use is less than 140 gallons per capita per day. Surface water was not chosen as an alternative for this small water system, because the system is not large enough to cost-effectively treat surface water, and there are currently no surface water wholesalers within close proximity. NTMWD currently has water at Farmersville, about 15 miles away, which could become a viable source much later in the planning period. Water reuse was not selected because there is no centralized collection system. Ground water was considered as the system's primary source to meet the projected deficit. A groundwater worksheet is included as Attachment B.

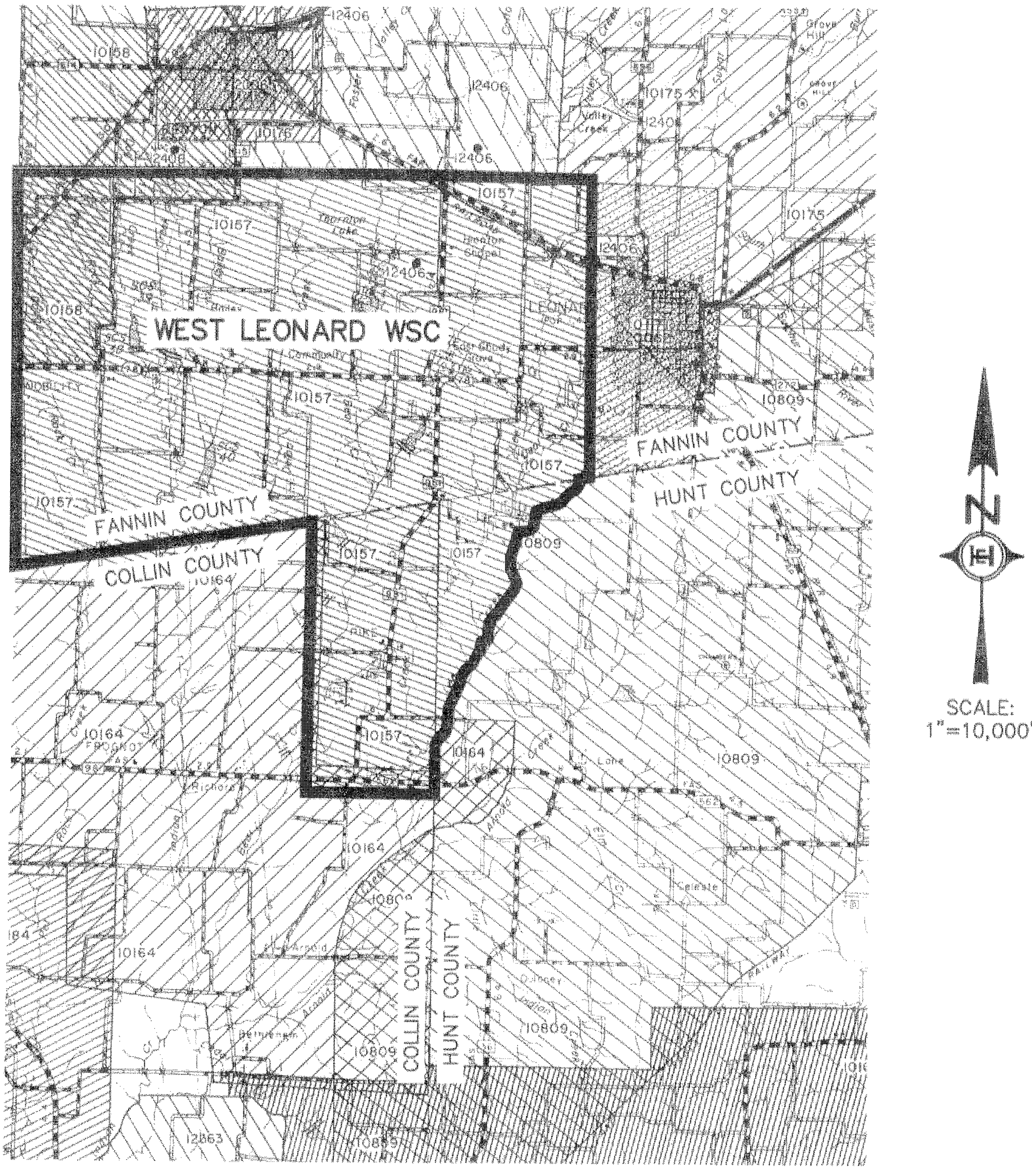
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**81**	**$890,430**	**$79,319**	**$580**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	81	81	81	81	81	81

Additional ground water from the Woodbine aquifer is the recommended strategy for West Leonard WSC to meet the projected deficit by 2010. One new well with a capacity of 150 gpm, or a total of 81 ac-ft/yr, should be achievable in Hunt County. Since only a small percentage of the users are located in Region D, the excess capacity from this well could be available for the system's meters in Region C.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be re-evaluated.



ATTACHMENT "A"
WEST LEONARD WSC
LOCATION MAP

Attachment B - Groundwater worksheet
West Leonard WSC
Hunt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
1	1800	150	**81**	$ 334.00	$ 601,200.00	$ 6,012.00	$ 607,212.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,600	6	$ 2.23	$ 34,788.00	$ 1,217.58	$ 36,005.58

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
-	-	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 643,217.58**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 192,965.27
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 856,182.85**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 51,370.97
4% Rate of Return on Investment of Unspent Funds	$ 17,123.66
Net Interest	**$ 34,247.31**
TOTAL CAPITAL COST	**$ 890,430.17**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 11,826.68

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	150	300	70%	1	0.06	$ 2,847.03

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 79,318.94**
WUG Total WMS Cost Per Acre-Foot	**$ 580.20**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

LAMAR COUNTY

WUGs:

Steam Electric

County Other:

Petty WSC

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF STEAM ELECTRIC IN LAMAR COUNTY

Description of Water User Group:

The Steam Electric WUG in Lamar County has a demand that is projected to grow from a demand of 5,940 ac-ft/yr in 2010 to 16,435 ac-ft/yr in 2060. Panda's steam electric contract with City of Paris is 8,961 ac-ft/yr. Steam electric is projected to have a deficit of 980 ac-ft/yr in 2030 and increasing to a deficit of 7,474 ac-ft/yr in 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Projected Water Demand	5940	8503	9941	11694	13831	16435
Current Water Supply	8961	8961	8961	8961	8961	8961
Projected Supply Surplus (+)/Deficit(-)	**3021**	**458**	**-980**	**-2733**	**-4870**	**-7474**

Evaluation of Potentially Feasible Water Management Strategies:

Three alternative strategies were considered to meet the Lamar County Steam Electric WUG's water supply shortages. In this round of planning, estimates were not made for electric power water conservation because data on operating strategies for each power plant was not available. Groundwater is also not feasible due to questionable reliability and the large quantity required for a steam electric facility. Surface water from surrounding lakes was considered as a viable alternative to meet projected demands. A surface water purchase worksheet is included as Attachment A.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**7,474**	**$ 0**	**$ 174,406**	**$ 65**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	**0**	**0**	**980**	**2733**	**4870**	**7474**

The recommended strategy for the Lamar County steam electric WUG to meet projected demands during the planning period is to purchase raw water from the City of Paris's Pat Mayse Lake. A capital cost is not included for this alternative since Panda's steam electric facilities is already in place.

Attachment A - Surface Water worksheet
Steam Electric
Lamar County

Water Purchase from City of Paris:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
6,672,357	**7474**	$ 0.20

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
<u>Other Capital Costs</u>	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	980	2733	4870	7474	2,676
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ 63,866.80	$ 178,110.16	$ 317,378.87	$ 487,082.07	$ 174,406.32
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ -**	**$ 63,866.80**	**$ 178,110.16**	**$ 317,378.87**	**$ 487,082.07**	Average **$ 174,406.32**

UNIT COST
($ / ac-ft / yr) **$ 65.17**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF PETTY WATER SUPLY CORPORATION

Description of Water User Group:

Petty WSC is a very small public water supply located in western Lamar County along US Highway 82. It is surrounded on all sides by the Lamar County WSD. In 2003, Petty served 62 connections. The estimated population is 137 in the year 2010, and is projected to be 155 by the year 2060. Petty WSC is included in the County Other water user group for Lamar County. The current source of supply is a single 31 gpm well into the Woodbine formation. Water quality does not meet current TCEQ standards because of high TDS. Backup for the single well is provided through a 6" connection to Lamar County WSD. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	137	146	154	163	159	155
Projected Water Demand	18	19	20	21	20	20
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	17	17	0	0	0	0
Projected Supply Surplus (+) / Deficit (-)	**-1**	**-2**	**-20**	**-21**	**-20**	**-20**

Evaluation of Potentially Feasible Water Management Strategies:

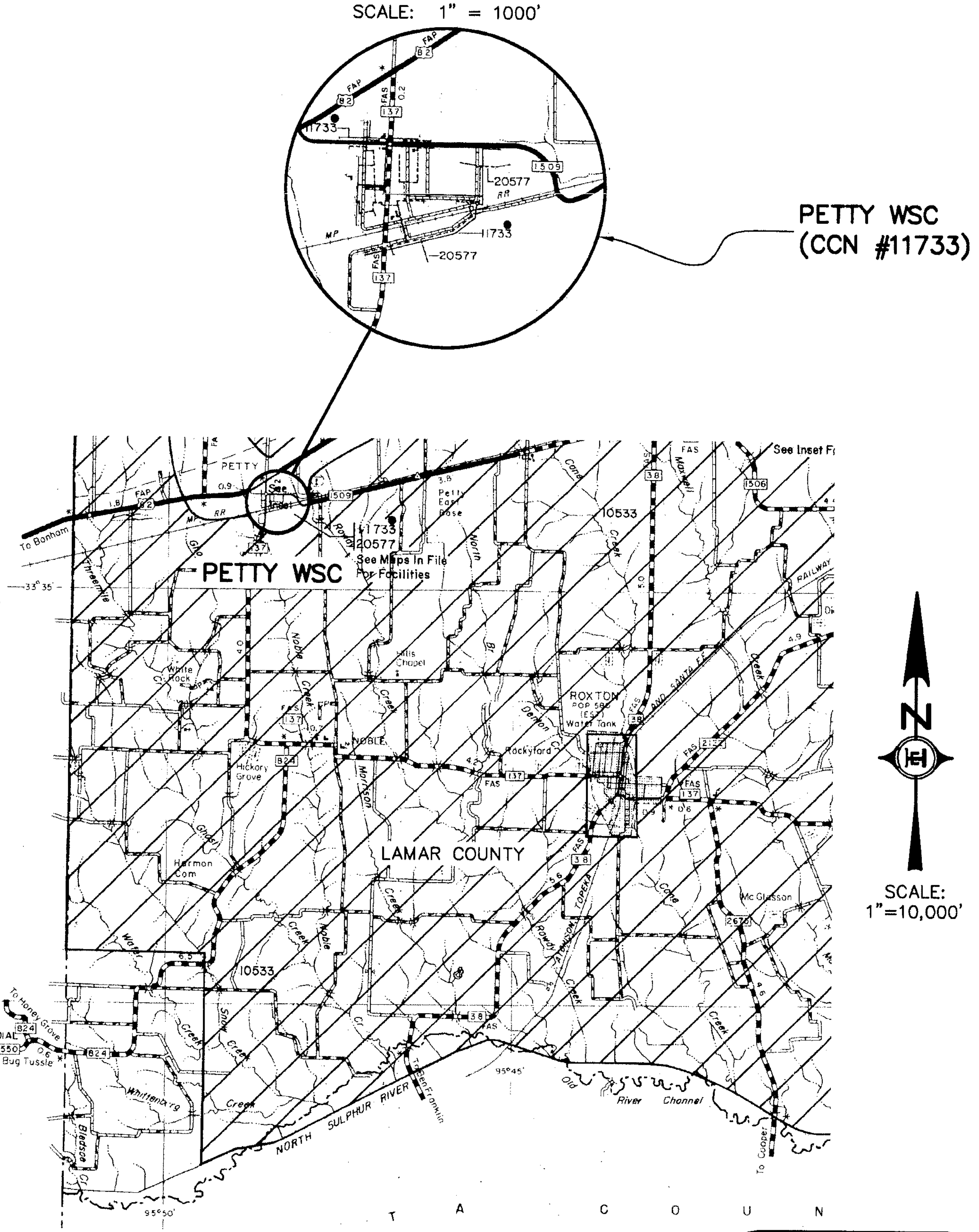
The alternative strategies listed in the table below were considered to meet Petty's water supply shortage. Advanced conservation was not selected since per capita use is less than 140 gpcpd, the threshold set by the planning group. All uses is for residential purposes, so there are no current water needs which could be met by water reuse. Groundwater is not of suitable quality. The existing well is projected to fail by 2020, and a replacement well will not be a viable option, since water quality is below TCEQ minimum standards. Treatment of the groundwater is not considered viable because of the operational complexity for a system of this size. Conversion to surface water by contracting with LCWSD was the alternative selected for this entity. A surface water purchase worksheet is included as Attachment B.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**21**	**$43,435**	**$12,981**	**$927**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	1	2	20	21	20	20

The recommended strategy is for Petty WSC to enter into a contract for treated surface water with Lamar County Water Supply District when necessary. LCWSD has adequate supply available, and already has facilities in-place to provide this service. There are no other suppliers in the Petty area with adequate facilities to meet Petty's needs. Given that facilities are in-place, capital costs would be negligible. Since LCWSD already has water available, and no significant construction would be required, environmental impact would be negligible.



ATTACHMENT "A"
PETTY WSC
LOCATION MAP

Attachment B - Surface Water worksheet
Petty WSC
Lamar County

Water Purchase Contract With Lamar County Water Supply District:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
18,748	**21.0**	$ 2.50

Pump Station

	Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
Rework Existing	1	$ 28,000.00	$ 28,000.00	$ 280.00	$ 28,280.00

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	10	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost		**$ 28,280.00**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)		**1.0**
Other Capital Costs		
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)		$ 8,484.00
ENVIRONMENTAL (LUMP SUM)		$ 5,000.00
Total Borrowed Funds		**$ 41,764.00**
INTEREST DURING CONSTRUCTION(IDC):	6% Annual Interest on Total Borrowed Funds	$ 2,505.84
	4% Rate of Return on Investment of Unspent Funds	$ 835.28
	Net Interest	**$ 1,670.56**
TOTAL CAPITAL COST		**$ 43,434.56**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	1	2	20	21	20	20	14
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 814.63	$ 1,629.26	$ 16,292.55	$ 17,107.18	$ 16,292.55	$ 16,292.55	$ 11,404.79
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 3,967.98**	**$ 4,782.60**	**$ 19,445.90**	**$ 17,107.18**	**$ 16,292.55**	**$ 16,292.55**	**$ 12,981.46**

UNIT COST
($ / ac-ft / yr) **$ 927.25**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

MARION COUNTY

WUGs:

None

County Other:

None

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

MORRIS COUNTY

WUGs:

None

County Other:

None

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

RAINS COUNTY

WUGs:

None

County Other:

South Rains WSC

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF SOUTH RAINS WATER SUPPLY CORPORATION IN RAINS COUNTY

Description of Water User Group:

South Rains WSC provides water service in Rains County. The WUG population is projected to be 2,706 in 2010 and 3,604 in the year 2060. The WSC has a contract for water supply with the City of Emory for 264 ac-ft/yr. The WSC is projected to have a deficit of 160 ac-ft in 2010 and increasing to a deficit of 277 ac-ft by 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	2706	3251	3599	3695	3669	3604
Projected Water Demand	424	502	548	559	551	541
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	264	264	264	264	264	264
Projected Supply Surplus (+) / Deficit (-)	**-160**	**-239**	**-284**	**-295**	**-287**	**-277**

Evaluation of Potentially Feasible Water Management Strategies:

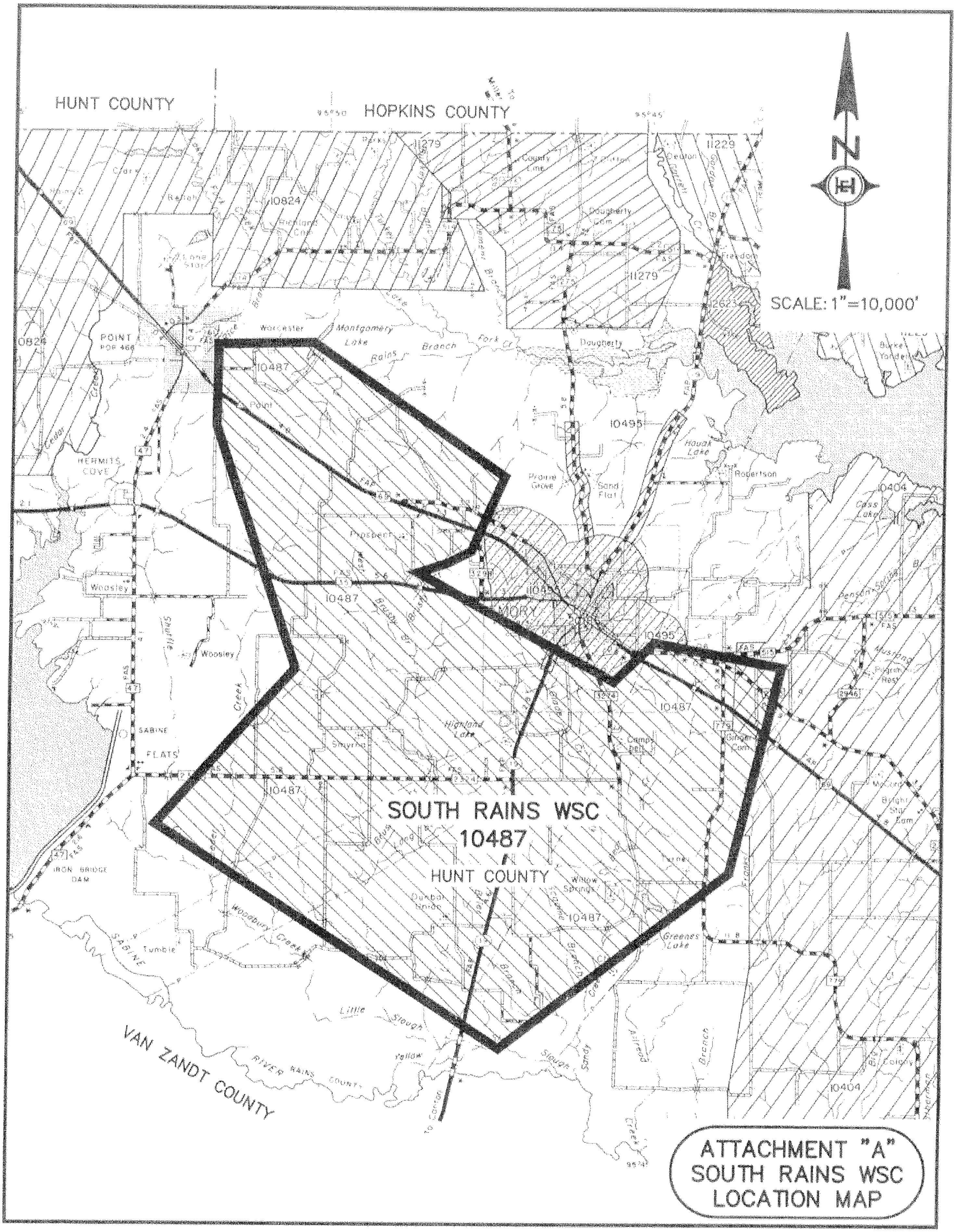
There were four alternative strategies considered to meet South Rains WSC's water supply shortages as summarized in the Table below. Advanced conservation was considered because the per capita use per day was greater than the 140 gpcd threshold set by the water planning group. Reuse is not a feasible option because water supply is mainly used for public consumption. Groundwater was not selected because the WSC is planning on continuing to purchase surface water from the City of Emory.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation	**28**	**$187,197**	-	**$726**	**Minimal**
Water Reuse					
Ground Water					
Surface Water	**295**	**$0**	**$175,024**	**$681**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	160	239	284	295	287	277

Surface water purchase from City of Emory is the recommended strategy to meet South Rains WSC's needs.


HUNT COUNTY
HOPKINS COUNTY
SCALE: 1"=10,000'
SOUTH RAINS WSC
10487
HUNT COUNTY
VAN ZANDT COUNTY
ATTACHMENT "A"
SOUTH RAINS WSC
LOCATION MAP

Surface Water Worksheet
South Rains WSC
Rains County

Water Purchase Contract With City of Emory:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
263,359	**295.0**	$ 2.09

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
-	-	$ 1.67	$ -	$ -	$ -

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	160	239	284	295	287	277	257
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 108,964.57	$ 162,765.83	$ 193,412.12	$ 200,903.43	$ 195,455.21	$ 188,644.92	$ 175,024.35
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 108,964.57**	**$ 162,765.83**	**$ 193,412.12**	**$ 200,903.43**	**$ 195,455.21**	**$ 188,644.92**	**$ 175,024.35**

UNIT COST
($ / ac-ft / yr) **$ 681.03**

Conservation Worksheet

Cost-Savings Analysis for Region D - South Rains WSC

Regional Data	
Population	3,421
SF Population	3,421
MF Population	-
Institutional Population	-
SF Units	1,368
MF Units	-
Average Yearly Rainfall (inches)	42.9
SF Household Size	2.50
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	-
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
SF Toilet Retrofit	10.5	26.3	2.0	13.1	10%	50%	-	-	-	$ -	$ -	$ -	free or rebate
SF Showerheads and Aerators	5.5	13.8	2.0	6.9	10%	50%	-	-	-	$ -	$ -	$ -	kits picked up by customer
SF Clothes Washer Rebate	5.6	14.0	1.0	14.0	0%	90%	1,232	17,242	19.31	$ 120	$ 147,787	$ 815	rebate from water utility only
SF Irrigation Audit-High User	20.0	50.0	1.0	50.0	1%	5%	55	2,737	3.07	$ 70	$ 3,832	$ 459	staff
SF Rainwater Harvesting	18.9	47.2	1.0	47.2	0%	5%	68	3,230	3.62	$ 250	$ 17,105	$ 456	rebate
SF Rain Barrels	2.0	5.1	1.0	5.1	0%	30%	411	2,098	2.35	$ 45	$ 18,473	$ 757	rebate or distribution
MF Toilet Retrofit													
MF Showerheads and Aerators													
MF Clothes Washer Rebate													
MF Irrigation Audit													
MF Rainwater Harvesting													
								25,306	28		$ 187,197	$725.57	
Commercial													
Commercial Toilet Retrofit													
Coin-Operated Clothes Washer Rebate													
Irrigation Audit													
Commercial General Rebate													
Commercial Rainwater Harvesting													

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

RED RIVER COUNTY

WUGs:

None

County Other:

None

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

SMITH COUNTY

WUGs:

Crystal Systems Inc.
Lindale Rural WSC
City of Lindale
City of Winona

County Other:

Star Mountain WSC

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CRYSTAL SYSTEMS INC

Description of Water User Group:

Crystal Systems Inc. provides water service in northwestern Smith County in the Hideaway Lake Community. The CSI service area is bounded on the north by Duck Creek WSC, on the east by the City of Lindale and Lindale Rural WSC, and on the south by Southern Utilities Company. Crystal Systems Inc. is 92% in Region D and 8% in Region I. In 2003, the WSC served 1,700 connections. The projected population is 3,740 in the year 2010 and is projected to be 7,204 in the year 2060. The projected population in Region D is 3,419 in the year 2010 and is projected to be 6,649 in the year 2060. This evaluation is for the Region D portion and assumes demands in Region D will be met with supplies in Region D. Crystal Systems Inc. is included as a water user group for Smith County. The system is served by three wells from the Carrizo-Wilcox Aquifer with a total pumping capacity of 1,940 gpm, or 1,043 ac-ft/yr on an average annual basis. The Region D portion would be 960 ac-ft/yr. A location map is included as Attachment A.

Water Supply and Demand Analysis:

Region D Allocation	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population	3419	3889	4357	4824	5609	6649
Projected Water Demand	712	810	908	1005	1169	1385
Current Water Supply	960	960	960	960	960	960
Projected Supply Surplus (+) / Deficit (-)	+248	+150	+52	**-45**	**-209**	**-425**

Evaluation of Potentially Feasible Water Management Strategies:

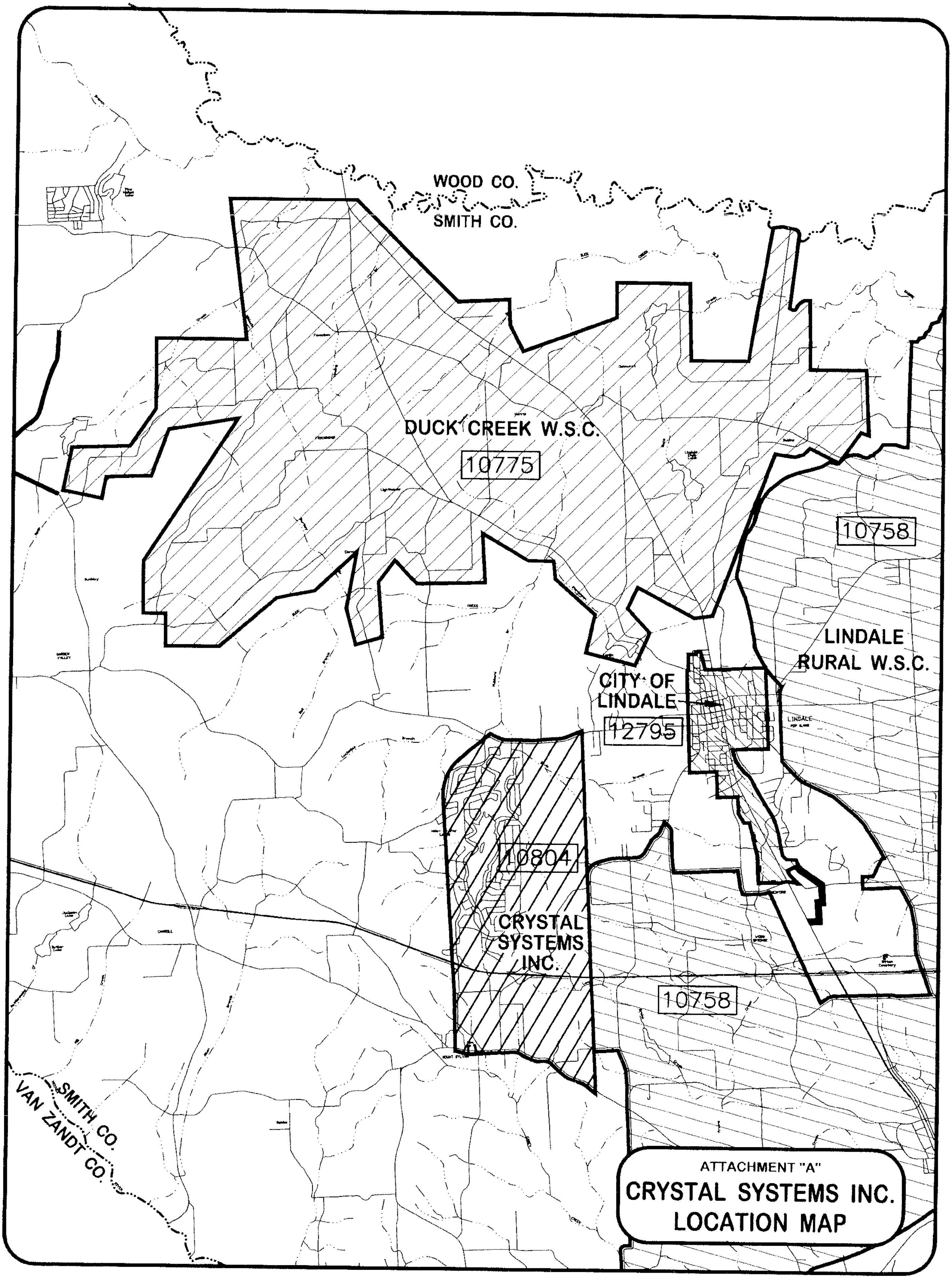
Four alternative strategies were considered to meet the Crystal Systems Inc. water supply shortages as summarized in the table below. Advanced conservation was considered because the per capita use per day of 186 is greater than the 140 gpcpd threshold set by the water planning group. Water reuse was omitted from consideration because CSI does not have a centralized sewerage collection system. Surface water alternatives were omitted since a surface water supply source is not available within reasonable proximity. A ground water worksheet is included as Attachment B and an advanced water conservation worksheet is included as Attachment C.

Strategy	**Firm Yield (ac-ft)**	**Total Capital Cost**	**Total Annualized Cost**	**Unit Cost**	**Environmental Impact**
Advanced Water Conservation	**41**	**$ 263,851**		**$ 703**	**Minimal**
Water Reuse					
Groundwater	**538**	**$ 992,200**	**$ 160,368**	**$ 485**	**Minimal**
Surface Water					

Recommendations:

	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Groundwater (ac-ft/yr)				269	269	538

The recommended strategy for Crystal Systems Inc. to meet their projected deficit of 45 ac-ft in the year 2040 and 425 ac-ft in the year 2060 would be to construct two additional water wells in the Carrizo-Wilcox Aquifer. One well with a total rated capacity of 500 gpm would provide approximately 269 ac-ft/yr each or 538 ac-ft/yr total for two wells. The wells will need to be constructed prior to the year 2040 and 2060. The supply source will be the Carrizo-Wilcox Aquifer in the Sabine Basin, Smith County. The aquifer has an adequate supply to meet the projected needs of Crystal Systems Inc.


WOOD CO.
SMITH CO.
DUCK CREEK W.S.C.
10775
10758
LINDALE
RURAL W.S.C.
CITY OF
LINDALE
12795
10804
CRYSTAL
SYSTEMS
INC.
10758
SMITH CO.
VAN ZANDT CO.
ATTACHMENT "A"
CRYSTAL SYSTEMS INC.
LOCATION MAP

Attachment B - Groundwater Worksheet
Crystal Systems Inc.
Smith County
WUG

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
2	1000	500	**538**	$ 334.00	$ 668,000.00	$ 16,700.00	$ 684,700.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
4,000	6	$ 1.67	$ 40,080.00	$ 1,402.80	$ 41,482.80

Total Construction Cost	**$ 726,182.80**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 217,854.84
ENVIRONMENTAL (LUMP SUM)	$ 10,000.00
Total Borrowed Funds	**$ 954,038.64**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 57,242.32
4% Rate of Return on Investment of Unspent Funds	$ 19,080.77
Net Interest	**$ 38,161.55**
TOTAL CAPITAL COST	**$ 992,200.19**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 78,844.54

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	500	150	70%	2	0.06	$ 9,490.11

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 160,368.38**
WUG Total WMS Cost Per Acre-Foot	**$ 484.50**

Crystal Systems Inc. Cost-Savings Analysis for Region D - Rural

Attachment C - Advanced Water Conservation Worksheet

WUG Data	
Population	5,034
SF Population	5,034
MF Population	-
Institutional Population	-
SF Units	1,929
MF Units	-
Average Yearly Rainfall (inches)	43.3
SF Household Size	2.61
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	1.2
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit													
SF Showerheads and Aerators													
SF Clothes Washer Rebate	5.6	14.6	1.0	14.6	0%	90%	1,736	25,371	28.42	$ 120	$ 208,303	$ 780	rebate from water utility only
SF Irrigation Audit-High User	19.2	50.0	1.0	50.0	1%	5%	77	3,857	4.32	$ 70	$ 5,400	$ 459	staff
SF Rainwater Harvesting	18.3	47.6	1.0	47.6	0%	5%	96	4,595	5.15	$ 250	$ 24,109	$ 451	rebate
SF Rain Barrels	2.0	5.2	1.0	5.2	0%	30%	579	2,985	3.34	$ 45	$ 26,038	$ 750	rebate or distribution
MF Toilet Retrofit	N/A												
MF Showerheads and Aerators	N/A												
MF Clothes Washer Rebate	N/A												
MF Irrigation Audit	N/A												
MF Rainwater Harvesting	N/A												
								36,808	41		$ 263,851.03	$ 703.11	
Commercial													
Commercial Toilet Retrofit	N/A												
Coin-Operated Clothes Washer Rebate	N/A												
Irrigation Audit	N/A												
Commercial General Rebate	N/A												
Commercial Rainwater Harvesting	N/A												

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF LINDALE RURAL WSC

Description of Water User Group:

Lindale Rural WSC provides water service in northern Smith County. The LR WSC service area is bounded on the west by Duck Creek WSC, Crystal Systems Inc., and the City of Lindale, on the north by the Sabine River, on the east by Sand Flat WSC, and on the south by Southern Utilities Company. Lindale Rural is 48% in Region D and 52% in Region I. In 2003, the WSC served 2,346 connections. The projected population is 5,135 in the year 2010 and is projected to be 9,828 in the year 2060. The projected population in Region D is 2,421 in the year 2010 and is projected to be 4,709 in the year 2060. This evaluation is for the Region D portion and assumes demands in Region D will be met with supplies in Region D. Lindale Rural WSC is included as a water user group for Smith County. The system is served by five wells from the Carrizo-Wilcox Aquifer with a total pumping capacity of 2,045 gpm, or 1,100 ac-ft/yr on an average annual basis. The Region D portion would be 528 ac-ft/yr. A location map is included as Attachment A.

Water Supply and Demand Analysis:

Region D Allocation	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population	2421	2754	3086	3416	3973	4709
Projected Water Demand	391	435	480	524	605	717
Current Water Supply	528	528	528	528	528	528
Projected Supply Surplus (+) / Deficit (-)	+137	+93	+48	+4	-77	**-189**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the Lindale Rural WSC water supply shortages as summarized in the table below. Advanced conservation was considered because the per capita use per day of 149 is greater than the 140 gpcpd threshold set by the water planning group. Water reuse was omitted from consideration because the WSC does not have a centralized sewerage collection system. Surface water alternatives were omitted since surface water supply source is not available within reasonable proximity. A ground water worksheet is included as Attachment B and an advanced water conservation worksheet is included as Attachment C.

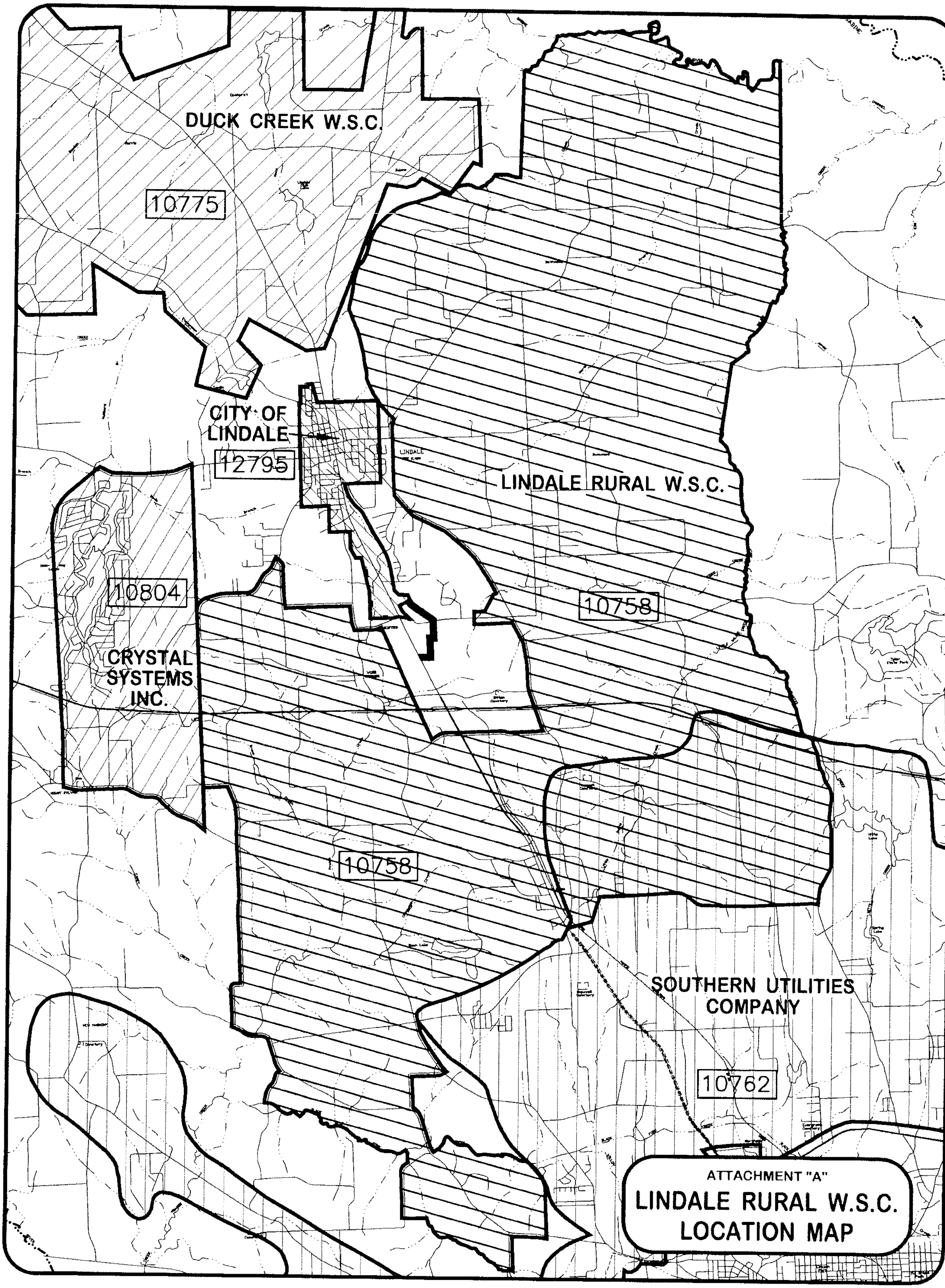
Strategy	**Firm Yield (ac-ft)**	**Total Capital Cost**	**Total Annualized Cost**	**Unit Cost**	**Environmental Impact**
Advanced Water Conservation	**29**	**$ 186,855**		**$ 703**	**Minimal**
Water Reuse					
Groundwater	**215**	**$ 316,158**	**$ 57,022**	**$ 265**	**Minimal**
Surface Water					

Recommendations:

	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Groundwater (ac-ft/yr)					215	215

The recommended strategy for Lindale Rural WSC to meet their projected deficit of 77 ac-ft in the year 2050 and 189 ac-ft in the year 2060 would be to construct one additional water well in the Carrizo-Wilcox Aquifer. One well with a total rated capacity of 400 gpm would provide approximately 215 ac-ft/yr. The well will need to be constructed by the year 2050. The supply source will be the Carrizo-Wilcox Aquifer in the Sabine Basin, Smith County. The aquifer has an adequate supply to meet the projected needs of LR WSC.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendation previously discussed should be disregarded and a re-evaluation completed.


DUCK CREEK W.S.C.
10775
CITY OF LINDALE
12795
10804
CRYSTAL SYSTEMS INC.
LINDALE RURAL W.S.C.
10758
10758
SOUTHERN UTILITIES COMPANY
10762
ATTACHMENT "A"
LINDALE RURAL W.S.C.
LOCATION MAP

Attachment B - Groundwater Worksheet
Lindale Rural WSC
Smith County
WUG

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
1	600	400	**215**	$ 334.00	$ 200,400.00	$ 5,010.00	$ 205,410.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,000	6	$ 1.67	$ 20,040.00	$ 701.40	$ 20,741.40

Total Construction Cost	**$ 226,151.40**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 67,845.42
ENVIRONMENTAL (LUMP SUM)	$ 10,000.00
Total Borrowed Funds	**$ 303,997.82**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 18,239.87
4% Rate of Return on Investment of Unspent Funds	$ 6,079.96
Net Interest	**$ 12,159.91**
TOTAL CAPITAL COST	**$ 316,157.73**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 31,537.81

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	400	100	70%	1	0.06	$ 2,530.69

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 57,021.56**
WUG Total WMS Cost Per Acre-Foot	**$ 265.22**

Lindale Rural WSC Cost-Savings Analysis for Region D - Rural

Attachment C - Advanced Water Conservation Worksheet

WUG Data	
Population	3,565
SF Population	3,565
MF Population	-
Institutional Population	-
SF Units	1,366
MF Units	-
Average Yearly Rainfall (inches)	43.3
SF Household Size	2.61
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	1.2
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit													
SF Showerheads and Aerators													
SF Clothes Washer Rebate	5.6	14.6	1.0	14.6	0%	90%	1,229	17,968	20.13	$ 120	$ 147,517	$ 780	rebate from water utility only
SF Irrigation Audit-High User	19.2	50.0	1.0	50.0	1%	5%	55	2,732	3.06	$ 70	$ 3,825	$ 459	staff
SF Rainwater Harvesting	18.3	47.6	1.0	47.6	0%	5%	68	3,254	3.64	$ 250	$ 17,074	$ 451	rebate
SF Rain Barrels	2.0	5.2	1.0	5.2	0%	30%	410	2,114	2.37	$ 45	$ 18,440	$ 750	rebate or distribution
MF Toilet Retrofit	N/A												
MF Showerheads and Aerators	N/A												
MF Clothes Washer Rebate	N/A												
MF Irrigation Audit	N/A												
MF Rainwater Harvesting	N/A												
								26,067	29		$ 186,855.17	$ 703.11	
Commercial													
Commercial Toilet Retrofit	N/A												
Coin-Operated Clothes Washer Rebate	N/A												
Irrigation Audit	N/A												
Commercial General Rebate	N/A												
Commercial Rainwater Harvesting	N/A												

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF LINDALE

Description of Water User Group:

The City of Lindale provides water service within its corporate boundaries in northern Smith County. The City of Lindale service area is bounded on the north and west by Duck Creek WSC and Crystal Systems Inc., and the Lindale Rural WSC on the east and the south. City of Lindale is 91% in Region D and 9% in Region I. In 2003, the City served 1,860 connections. The projected population is 3,724 in the year 2010 and is projected to be 7,683 in the year 2060. The projected population in Region D is 3,051 in the year 2010 and is projected to be 7,010 in the year 2060. This evaluation is for the Region D portion and assumes demands in Region D will be met with supplies in Region D. The City of Lindale is included as a water user group for Smith County. The system is served by four wells from the Carrizo-Wilcox Aquifer with a total pumping capacity of 2,300 gpm, or 1,237 ac-ft/yr on an average annual basis. The Region D portion would be 1,126 ac-ft/yr. A location map is included as Attachment A.

Water Supply and Demand Analysis:

Region D Allocation	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population	3051	3627	4201	4773	5736	7010
Projected Water Demand	680	796	913	1027	1227	1500
Current Water Supply	1126	1126	1126	1126	1126	1126
Projected Supply Surplus (+) / Deficit (-)	+446	+330	+213	+99	**-101**	**-374**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the City of Lindale water supply shortages as summarized in the table below. Advanced conservation was considered because the per capita use per day of 204 is greater than the 140 gpcpd threshold set by the water planning group. Water reuse was omitted from consideration because the City does not have an industrial end user needing that capacity. Surface water alternatives were omitted since groundwater is less expensive to treat and is available in larger quantities in this area. A ground water worksheet is included as Attachment B and an advanced water conservation worksheet is included as Attachment C.

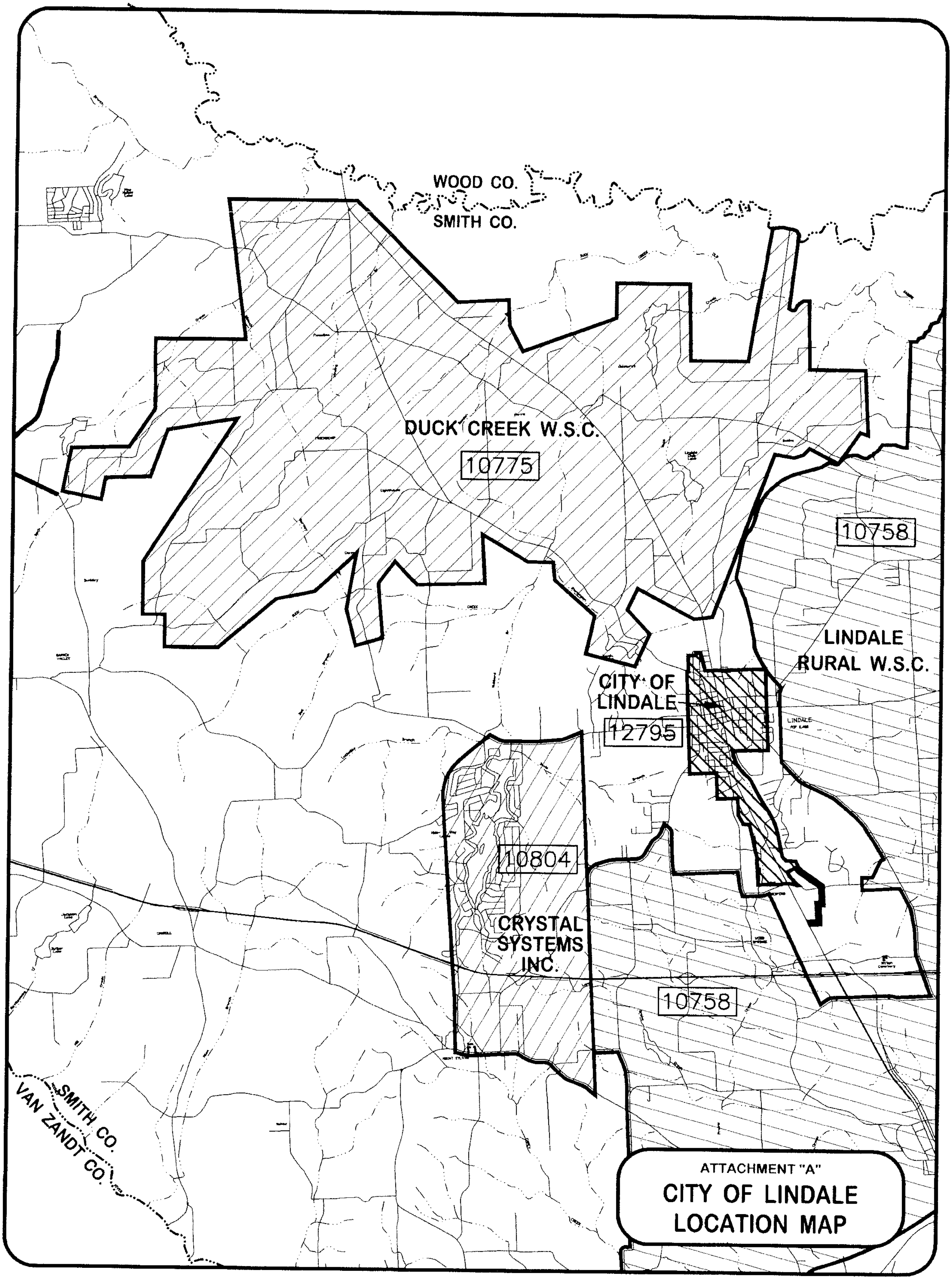
Strategy	**Firm Yield (ac-ft)**	**Total Capital Cost**	**Total Annualized Cost**	**Unit Cost**	**Environmental Impact**
Advanced Water Conservation	**39**	**$ 243,935**		**$ 692**	**Minimal**
Water Reuse					
Groundwater	**376**	**$ 510,648**	**$ 96,693**	**$ 257**	**Minimal**
Surface Water					

Recommendations:

	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Groundwater (ac-ft/yr)					376	376

The recommended strategy for City of Lindale to meet their projected deficit of 101 ac-ft in the year 2050 and 374 ac-ft in the year 2060 would be to construct one additional water well in the Carrizo-Wilcox Aquifer. One well with a total rated capacity of 700 gpm would provide approximately 376 ac-ft/yr. The well will need to be constructed by the year 2050. The supply source will be the Carrizo-Wilcox Aquifer in the Sabine Basin, Smith County. The aquifer has an adequate supply to meet the projected needs of the City of Lindale.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendation previously discussed should be disregarded and a re-evaluation completed.



WOOD CO.
SMITH CO.
DUCK CREEK W.S.C.
10775
10758
LINDALE
RURAL W.S.C.
CITY OF
LINDALE
12795
10804
CRYSTAL
SYSTEMS
INC.
10758
SMITH CO.
VAN ZANDT CO.
ATTACHMENT "A"
CITY OF LINDALE
LOCATION MAP

Attachment B - Groundwater Worksheet
City of Lindale
Smith County
City Category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
1	1000	700	**376**	$ 334.00	$ 334,000.00	$ 8,350.00	$ 342,350.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,000	8	$ 1.67	$ 26,720.00	$ 935.20	$ 27,655.20

Total Construction Cost	**$ 370,005.20**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 111,001.56
ENVIRONMENTAL (LUMP SUM)	$ 10,000.00
Total Borrowed Funds	**$ 491,007.76**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 29,460.47
4% Rate of Return on Investment of Unspent Funds	$ 9,820.16
Net Interest	**$ 19,640.31**
TOTAL CAPITAL COST	**$ 510,648.07**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 55,191.18

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	700	100	70%	1	0.06	$ 4,428.72

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 96,692.94**
WUG Total WMS Cost Per Acre-Foot	**$ 257.16**

City of Lindale Cost-Savings Analysis for Region D - Rural

Attachment C - Advanced Water Conservation

WUG Data	
Population	5,031
SF Population	4,700
MF Population	225
Institutional Population	106
SF Units	1,774
MF Units	150
Average Yearly Rainfall (inches)	43.3
SF Household Size	2.65
MF Houshold Size	1.50
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	1.2
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	18
No. of MF Units per Complex	50

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit	N/A												
SF Showerheads and Aerators	N/A												
SF Clothes Washer Rebate	5.6	14.8	1.0	14.8	0%	90%	1,596	23,688	26.53	$ 120	$ 191,547	$ 768	rebate from water utility only
SF Irrigation Audit-High User	18.9	50.0	1.0	50.0	1%	5%	71	3,547	3.97	$ 70	$ 4,966	$ 459	staff
SF Rainwater Harvesting	18.0	47.6	1.0	47.6	0%	5%	89	4,225	4.73	$ 250	$ 22,170	$ 451	rebate
SF Rain Barrels	1.9	5.2	1.0	5.2	0%	30%	532	2,744	3.07	$ 45	$ 23,943	$ 750	rebate or distribution
MF Toilet Retrofit	N/A												
MF Showerheads and Aerators	N/A												
MF Clothes Washer Rebate	1.1	1.7	0.056	30.0	2%	80%	6	194	0.22	$ 120	$ 778	$ 553	rebate from water utility only
MF Irrigation Audit	1.7	2.5	NA	125.0	0%	50%	1	187	0.21	$ 150	$ 224	$ 393	staff
MF Rainwater Harvesting	7.4	11.1	NA	553.8	0%	5%	0	83	0.09	$ 2,050	$ 307	$ 318	rebate
								34,669	**39**		**$ 243,935.09**	**$ 692.43**	
Commercial													
Commercial Toilet Retrofit	N/A												
Coin-Operated Clothes Washer Rebate	N/A												
Irrigation Audit	N/A												
Commercial General Rebate	N/A												
Commercial Rainwater Harvesting	N/A												

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF WINONA

Description of Water User Group:

The City of Winona provides water service to the residents within its corporate boundary in central northern Smith County. The City of Winona service area is bounded on the north, west and south by Sand Flat WSC and on the east by Star Mountain WSC. In 2003, the City served 270 connections. The projected population is 586 in the year 2010 and is projected to be 1,135 in the year 2060. The City of Winona is included as a water user group for Smith County. The system is served by one well from the Carrizo-Wilcox Aquifer with a total pumping capacity of 400 gpm, or 215 ac-ft/yr on an average annual basis and a water purchase contract with Smith County WCID No. 1. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	672	739	806	873	986	1135
Projected Water Demand	107	115	123	131	147	169
Current Water Supply	118	124	133	141	152	164
Projected Supply Surplus (+) / Deficit (-)	+11	+9	+10	+10	+5	**-5**

Evaluation of Potentially Feasible Water Management Strategies:

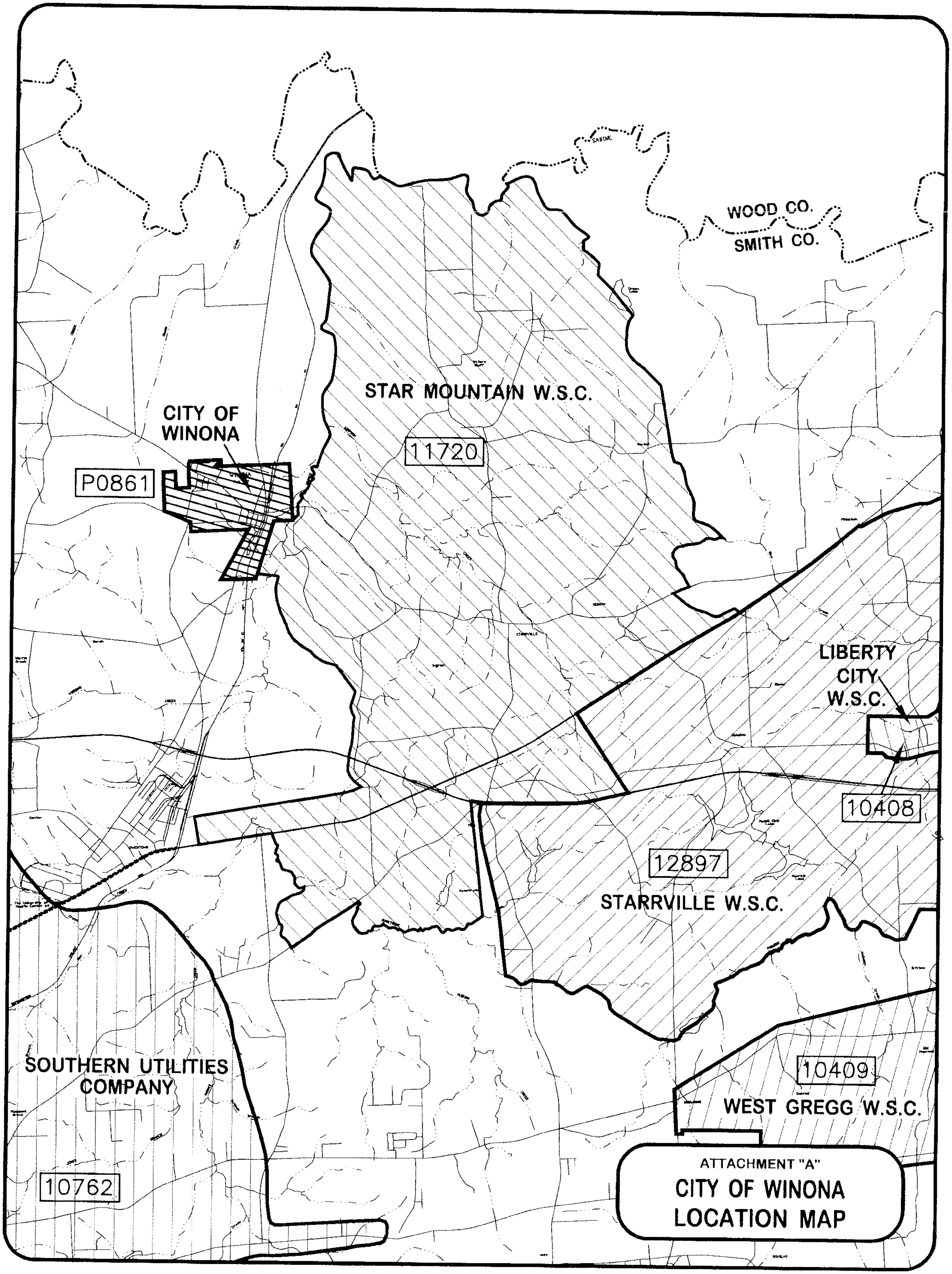
Four alternative strategies were considered to meet the City of Winona water supply shortages as summarized in the table below. Advanced conservation was considered because the per capita use per day of 147 is greater than the 140 gpcpd threshold set by the water planning group. Water reuse was omitted from consideration because the WSC does not have a centralized sewerage collection system. Surface water alternatives were omitted since surface water treatment is not practical for a system of this size. A ground water worksheet is included as Attachment B and an advanced water conservation worksheet is included as Attachment C.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation	7	**$ 48,308**		**$ 713**	**Minimal**
Water Reuse					
Groundwater (Purchase)	5	**$ 0**	**$ 5,621**	**$ 1,124**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)						5

The recommended strategy for the City of Winona to meet their projected deficit of 5 ac-ft in the year 2060 would be to increase their contract with Smith County WCID No. 1. The supply source will be the Carrizo-Wilcox aquifer in the Sabine Basin, Smith County. The aquifer has an adequate supply to meet the projected needs of City of Winona. The City of Winona should implement advanced conservation measures due to their high per capita water use.



ATTACHMENT "A"
CITY OF WINONA
LOCATION MAP

Attachment B - Surface Water Worksheet
City of Winona
Smith County
City Category

Water Purchase Contract With Northeast Texas Municipal Water District:

Avg. yield (GPD)	Total yield (GPD)	Total Yield (AF/YR)	Unit Cost ($ / 1000GAL)
4,464	4,464	**5.0**	$ 3.00

OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 733.16
Water Purchase Cost (Average Yield (AF/yr) * 325,851 * $ 3.00/ 1,000)	$ 4,888.08
TOTAL ANNUALIZED COST (O & M Cost + Water Purchase Cost)	**$ 5,621.24**
UNIT COST ($ / AC-FT / yr)	**$ 1,124.25**

City of Winona Cost-Savings Analysis for Region D - Rural

Attachment C - Advanced Water Conservation Worksheet

WUG Data	
Population	904
SF Population	904
MF Population	-
Institutional Population	-
SF Units	353
MF Units	-
Average Yearly Rainfall (inches)	43.3
SF Household Size	2.56
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	1.2
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit													
SF Showerheads and Aerators													
SF Clothes Washer Rebate	5.6	14.3	1.0	14.3	0%	90%	318	4,556	5.10	$ 120	$ 38,138	$ 796	rebate from water utility only
SF Irrigation Audit-High User	19.5	50.0	1.0	50.0	1%	5%	14	706	0.79	$ 70	$ 989	$ 459	staff
SF Rainwater Harvesting	18.6	47.6	1.0	47.6	0%	5%	18	841	0.94	$ 250	$ 4,414	$ 451	rebate
SF Rain Barrels	2.0	5.2	1.0	5.2	0%	30%	106	546	0.61	$ 45	$ 4,767	$ 750	rebate or distribution
MF Toilet Retrofit	N/A												
MF Showerheads and Aerators	N/A												
MF Clothes Washer Rebate	N/A												
MF Irrigation Audit	N/A												
MF Rainwater Harvesting	N/A												
								6,650	7		$ 48,307.50	$ 712.52	
Commercial													
Commercial Toilet Retrofit	N/A												
Coin-Operated Clothes Washer Rebate	N/A												
Irrigation Audit	N/A												
Commercial General Rebate	N/A												
Commercial Rainwater Harvesting	N/A												

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF STAR MOUNTAIN WSC

Description of Water User Group:

Star Mountain WSC provides water service in northeastern Smith County. The SMWSC service area is bounded on the west by Sand Flat WSC, on the north by the Sabine River, on the east by Starrville WSC, and on the south by Smith County WCID No. 1. In 2003, the WSC served 452 connections. The projected population is 1,190 in the year 2010 and is projected to be 2,313 in the year 2060. Star Mountain WSC is included in the County Other water user group for Smith County. The system is served by three wells from the Carrizo-Wilcox Aquifer with a total pumping capacity of 400 gpm, or 215 ac-ft/yr on an average annual basis. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	1190	1353	1516	1679	1952	2313
Projected Water Demand	163	182	199	216	251	298
Current Water Supply	215	215	215	215	215	215
Projected Supply Surplus (+) / Deficit (-)	+62	+32	+16	**-1**	**-36**	**-83**

Evaluation of Potentially Feasible Water Management Strategies:

Four alternative strategies were considered to meet the Star Mountain WSC water supply shortages as summarized in the table below. Advanced conservation was considered because the per capita use per day of 161 is greater than the 140 gpcpd threshold set by the water planning group. Water reuse was omitted from consideration because the WSC does not have a centralized sewerage collection system. Surface water alternatives were omitted since surface water supply source is not available within reasonable proximity. A ground water worksheet is included as Attachment B and an advanced water conservation worksheet is included as Attachment C.

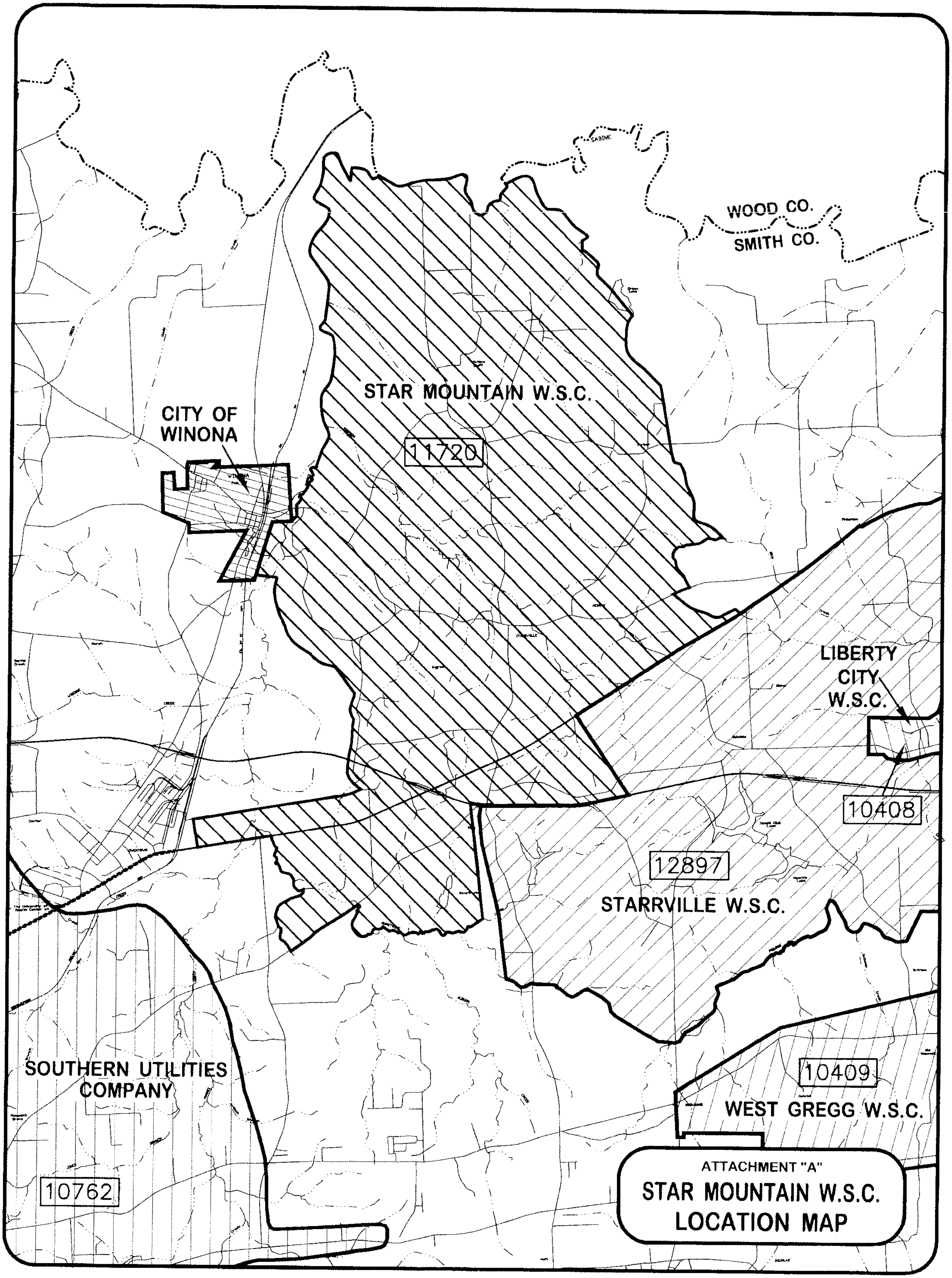
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation	**14**	**$ 91,829**		**$ 703**	**Minimal**
Water Reuse					
Groundwater	**108**	**$ 316,158**	**$ 39,987.31**	**$ 265**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)				108	108	108

The recommended strategy for Star Mountain WSC to meet their projected deficit of 1 ac-ft in the year 2040 and 83 ac-ft in the year 2060 would be to construct one additional water well in the Carrizo-Wilcox Aquifer. One well with a total rated capacity of 200 gpm would provide approximately 108 ac-ft/yr. The well will need to be constructed by the year 2040. The supply source will be the Carrizo-Wilcox Aquifer in the Sabine Basin, Smith County. The aquifer has an adequate supply to meet the projected needs of SM WSC.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendation previously discussed should be disregarded and a re-evaluation completed.


WOOD CO.
SMITH CO.
STAR MOUNTAIN W.S.C.
11720
CITY OF WINONA
LIBERTY CITY W.S.C.
10408
12897
STARRVILLE W.S.C.
SOUTHERN UTILITIES COMPANY
10409
WEST GREGG W.S.C.
10762
ATTACHMENT "A"
STAR MOUNTAIN W.S.C.
LOCATION MAP

Attachment B - Groundwater Worksheet
Star Mountain WSC
Smith County
County Other Category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
1	600	200	**108**	$ 334.00	$ 200,400.00	$ 5,010.00	$ 205,410.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,000	6	$ 1.67	$ 20,040.00	$ 701.40	$ 20,741.40

Total Construction Cost	**$ 226,151.40**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 67,845.42
ENVIRONMENTAL (LUMP SUM)	$ 10,000.00
Total Borrowed Funds	**$ 303,997.82**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 18,239.87
4% Rate of Return on Investment of Unspent Funds	$ 6,079.96
Net Interest	**$ 12,159.91**
TOTAL CAPITAL COST	**$ 316,157.73**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 15,768.91

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	200	100	70%	1	0.06	$ 1,265.35

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 39,987.31**
WUG Total WMS Cost Per Acre-Foot	**$ 265.12**

Star Mountain WSC Cost-Savings Analysis for Region D - Rural

Attachment C - Advanced Water Conservation Worksheet

WUG Data	
Population	1,752
SF Population	1,752
MF Population	-
Institutional Population	-
SF Units	671
MF Units	-
Average Yearly Rainfall (inches)	43.3
SF Household Size	2.61
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	1.2
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit													
SF Showerheads and Aerators													
SF Clothes Washer Rebate	5.6	14.6	1.0	14.6	0%	90%	604	8,830	9.89	$ 120	$ 72,497	$ 780	rebate from water utility only
SF Irrigation Audit-High User	19.2	50.0	1.0	50.0	1%	5%	27	1,343	1.50	$ 70	$ 1,880	$ 459	staff
SF Rainwater Harvesting	18.3	47.6	1.0	47.6	0%	5%	34	1,599	1.79	$ 250	$ 8,391	$ 451	rebate
SF Rain Barrels	2.0	5.2	1.0	5.2	0%	30%	201	1,039	1.16	$ 45	$ 9,062	$ 750	rebate or distribution
MF Toilet Retrofit	N/A												
MF Showerheads and Aerators	N/A												
MF Clothes Washer Rebate	N/A												
MF Irrigation Audit	N/A												
MF Rainwater Harvesting	N/A												
								12,810	14		$ 91,828.97	$ 703.11	
Commercial													
Commercial Toilet Retrofit	N/A												
Coin-Operated Clothes Washer Rebate	N/A												
Irrigation Audit	N/A												
Commercial General Rebate	N/A												
Commercial Rainwater Harvesting	N/A												

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

TITUS COUNTY

WUGs:

Steam Electric

County Other:

None

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF STEAM ELECTRIC IN TITUS COUNTY

Description of Water User Group:

The Steam Electric WUG in Titus County has a demand that is projected to grow from 51,804 ac-ft/yr in 2010 to 101,329 ac-ft/yr in 2060. Both TXU and SWEPCO have plants in Titus County. Steam electric is projected to have a deficit of 2,137 ac-ft/yr in 2040 and increasing to a deficit of 31,552 ac-ft/yr in 2060.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Projected Water Demand	51804	52423	61288	72096	85270	101329
Current Water Supply	70229	70139	70049	69959	69869	69777
Projected Supply Surplus (+)/Deficit(-)	**18425**	**17716**	**8761**	**-2137**	**-15401**	**-31552**

Evaluation of Potentially Feasible Water Management Strategies:

Three alternative strategies were considered to meet the Titus County Steam Electric WUG's water supply shortages. In this round of planning, estimates were not made for electric power water conservation because data on operating strategies for each power plant was not available. Groundwater is also not feasible due to questionable reliability and the large quantity required for a steam electric facility. Surface water from surrounding lakes was considered as a viable alternative to meet projected demands. A surface water purchase worksheet is included as Attachment A.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water					
Surface Water	**31,552**	**$ 0**	**$ 5,332,009**	**$ 652**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Surface Water (ac-ft/yr)	**0**	**0**	**0**	**2,137**	**15,401**	**31,552**

The recommended strategy for the Titus County steam electric WUG to meet projected demands during the planning period is to purchase raw water from the Northeast Texas MWD. The MWD receives supplies from several lakes, and Lake O the Pines has the largest yield. At this stage it is assumed that the steam electric water needs will be met from this lake. A capital cost cannot be included for this alternative since the location of the future generator facilities is unknown.

Attachment A - Surface Water worksheet
Steam Electric
Titus County

Water Purchase from Northeast Texas Water Supply District:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
28,167,810	**31552**	$ 2.00

Total Construction Cost	**$ -**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
<u>Other Capital Costs</u>	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ -
ENVIRONMENTAL (LUMP SUM)	$ -
Total Borrowed Funds	**$ -**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ -
4% Rate of Return on Investment of Unspent Funds	$ -
Net Interest	**$ -**
TOTAL CAPITAL COST	**$ -**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	0	2137	15401	31552	8,182
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ -	$ 1,392,687.17	$ 10,036,862.50	$ 20,562,501.50	$ 5,332,008.53
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ -**	**$ -**	**$ -**	**$ 1,392,687.17**	**$ 10,036,862.50**	**$ 20,562,501.50**	**$ 5,332,008.53**

UNIT COST
($ / ac-ft / yr) **$ 651.70**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

UPSHUR COUNTY

WUGs:

Pritchett WSC

County Other:

None

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF PRITCHETT WSC

Description of Water User Group:

Pritchett WSC is located in southwestern Upshur County and eastern Wood County and serves an area around the communities of Pritchett, Center Point, Latch, Shady Grove, and Wilkins. In 2003 the system had 2,305 members with 99% in Upshur County and 1% in Wood County. The population is projected to increase from 5,670 persons in 2010 to 6,998 persons in 2060. The PWSC is included as a WUG for Upshur and Wood Counties. The system's current water supply consists of seventeen water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 1,582 gpm, or 850 ac-ft/yr. The system is bounded on the west by Fouke WSC, on the north by Sharon WSC and the City of Gilmer, on the south by the cities of Gladewater and Big Sandy, and on the east by Union Grove WSC and Glenwood WSC. PWSC has a water conservation plan and a drought management plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	5670	6167	6478	6656	6795	6998
Projected Water Demand	731	794	834	857	875	901
Current Water Supply	850	850	850	850	850	850
Projected Supply Surplus(+)/Deficit(-)	+119	+56	+16	-7	**-25**	**-51**

Evaluation of Potentially Feasible Water Management Strategies:

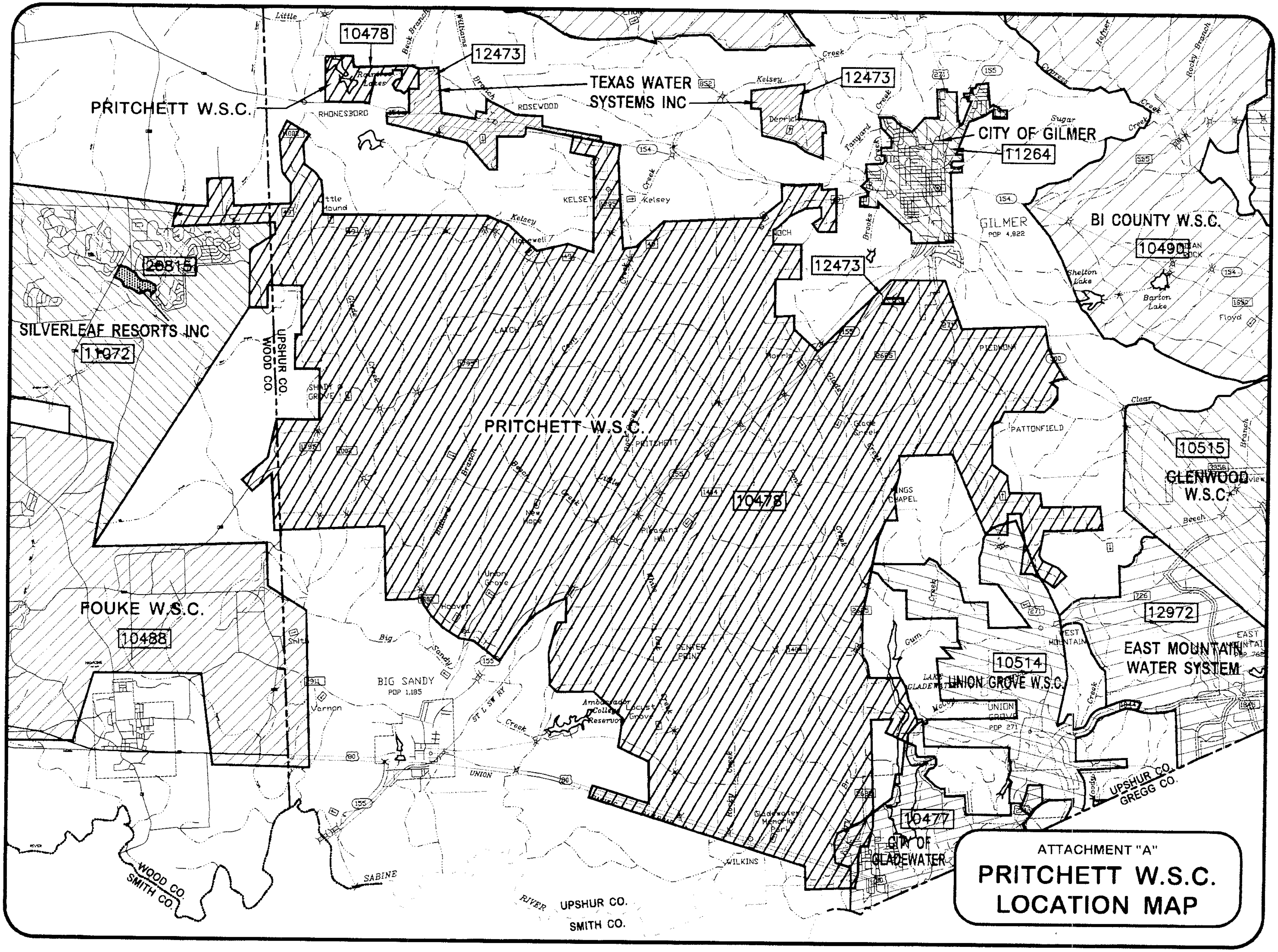
Four alternative strategies were considered to meet the PWSC water supply shortages as summarized in the following table. Advanced conservation was omitted because the per capita use per day was below the 140 gpcpd threshold set by the water planning group. Water reuse was omitted because the PWSC does not have a centralized sewerage collection system. Surface water was considered but there are not any existing surface water treatment facilities within reasonable distance from Pritchett WSC. A worksheet for the groundwater alternative is included as Attachments B. There are alternative sources of surface water available to PWSC such as Lake Gilmer, but the cost of purchasing raw water and building a surface water treatment plant is not realistic when compared to existing groundwater.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Groundwater	**54**	**$ 270,925**	**$ 28,186**	**$ 341**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)				54	54	54

The recommended strategy for the Pritchett WSC to meet their projected deficit of 7 ac-ft/yr in 2010 and 51 ac-ft/yr in 2060 would be to construct one additional well with a minimum capacity of 100 gpm which yields 54 ac-ft/yr. The recommended supply source will be the Carrizo-Wilcox Aquifer in Upshur County. The Carrizo-Wilcox Aquifer in Upshur County is projected to have a more than ample supply availability to meet the needs of Pritchett WSC for the planning period.



ATTACHMENT "A"

PRITCHETT W.S.C.

LOCATION MAP

Attachment B - Groundwater Worksheet
Pritchett WSC
Upshur & Wood Counties
WUG

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
1	500	100	**54**	$ 334.00	$ 167,000.00	$ 4,175.00	$ 171,175.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,000	4	$ 1.67	$ 13,360.00	$ 467.60	$ 13,827.60

Total Construction Cost	**$ 185,002.60**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 55,500.78
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 260,504.38**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 15,630.26
4% Rate of Return on Investment of Unspent Funds	$ 5,210.09
Net Interest	**$ 10,420.18**
TOTAL CAPITAL COST	**$ 270,924.56**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 7,884.45

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	100	100	70%	1	0.06	$ 632.67

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 28,186.25**
WUG Total WMS Cost Per Acre-Foot	**$ 341.30**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

VAN ZANDT COUNTY

WUGs:

Bethel Ash WSC
City of Canton
City of Grand Saline
R-P-M WSC

County Other:

Corinth WSC
Crooked Creek WSC
Edom WSC
Fruitvale WSC
Little Hope-Moore WSC

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF BETHEL ASH WATER SUPPLY CORPORATION IN VAN ZANDT COUNTY

Description of Water User Group:

Bethel Ash WSC provides water services in Van Zandt County (Region D) and Henderson County (Region C and I). The water management strategy listed here is meant to satisfy the portion of the WUG in Van Zandt County. The system is projected to serve 475 people in 2010 and 797 people by the year 2060 in Van Zandt County. The current sources of supply are seven wells into the Carrizo Wilcox with a total production capacity of 1257 gpm. This total supply was distributed to Region C, D and I based on demand in the respective regions. In Region D, Bethel Ash is projected to have a water supply deficit of 2 ac-ft/yr in 2040. The deficit is projected to increase to 17 ac-ft/yr by 2060. The system does not have a water conservation plan but has a drought management plan in place. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	475	552	617	666	728	797
Projected Water Demand	38	43	47	50	54	59
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	57	54	51	48	45	42
Projected Supply Surplus (+) / Deficit (-)	**19**	**11**	**4**	**-2**	**-9**	**-17**

Evaluation of Potentially Feasible Water Management Strategies:

The four alternative strategies considered to meet Bethel Ash's water supply shortages are listed in the table below. Advanced conservation was not selected since per capita use is less than 140 gpcpd. There are no current water needs in Bethel Ash that could be met by water reuse. Surface water was not selected because Bethel Ash stated in their survey response that they would continue to drill wells to meet future demands. Also, surface water treatment is not economically feasible for a system of this size. Groundwater from the Carrizo Wilcox was the alternative selected for this entity. A groundwater worksheet is included as Attachment B.

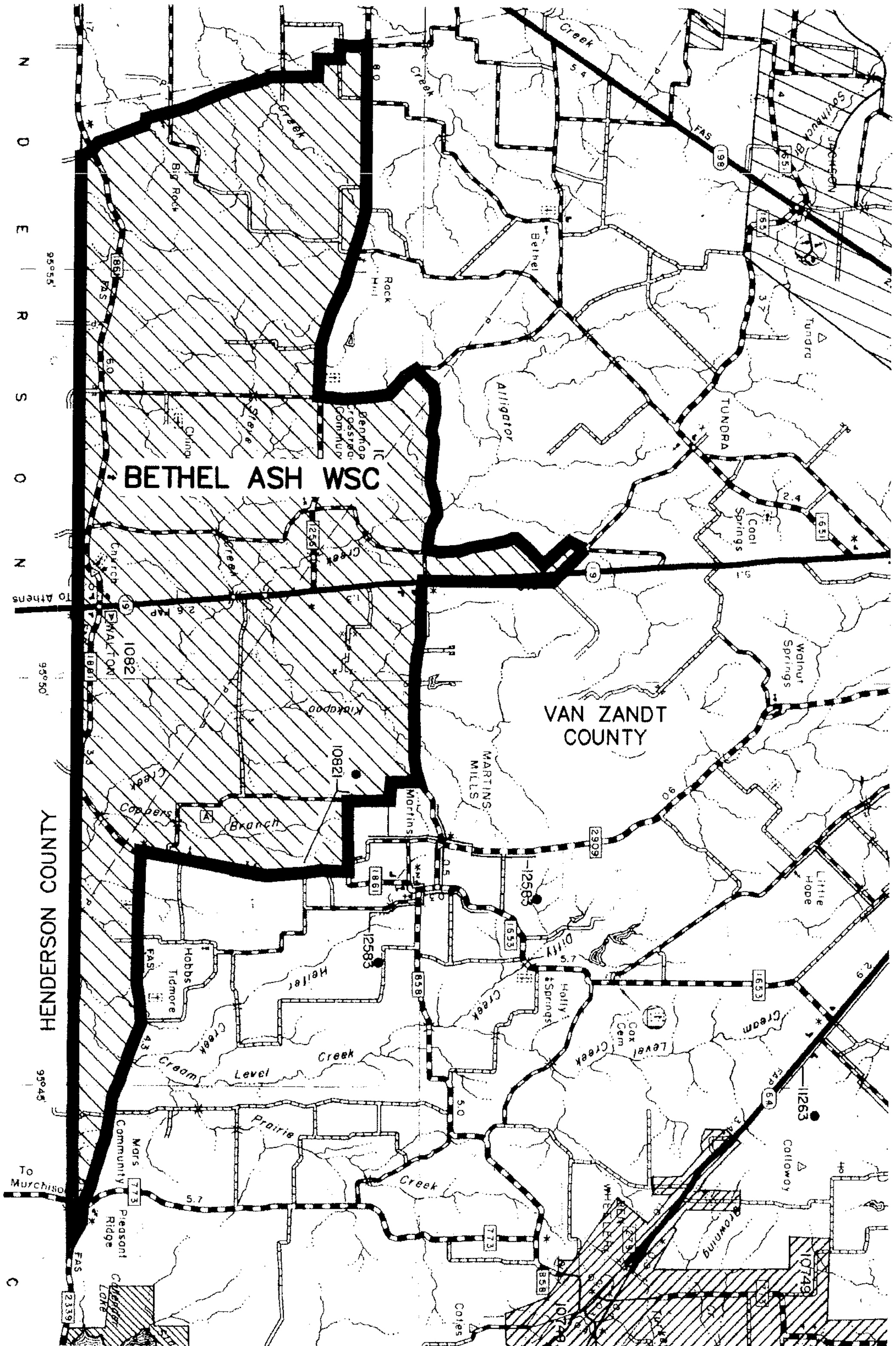
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**81**	**$337,913**	**$37,308**	**$513**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	0	0	0	81	81	81

The recommended strategy for the portion of Bethel Ash in Van Zandt County to meet their projected deficit in 2040 to 2060 is to construct a new well with a rated capacity of 150 gpm, which would provide a total of 81 ac-ft/yr. This is in excess of the needs in Region D, and would provide additional water for use in the neighboring users of region C.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be re-evaluated.



SCALE:
1"=10,000'

ATTACHMENT "A"
BETHEL ASH WSC
LOCATION MAP

Attachment B - Groundwater worksheet
BETHEL ASH WSC
Van Zandt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
1	550	150	**81**	$ 334.00	$ 183,700.00	$ 1,837.00	$ 185,537.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,600	6	$ 2.23	$ 34,788.00	$ 1,217.58	$ 36,005.58

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
1	23,000	$ 0.56	$ 12,880.00	$ 128.80	$ 13,008.80

Total Construction Cost	**$ 234,551.38**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 70,365.41
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 324,916.79**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 19,495.01
4% Rate of Return on Investment of Unspent Funds	$ 6,498.34
Net Interest	**$ 12,996.67**
TOTAL CAPITAL COST	**$ 337,913.47**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 11,826.68

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	150	100	70%	1	0.06	$ 949.01

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 37,308.21**
WUG Total WMS Cost Per Acre-Foot	**$ 513.17**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF CANTON

Description of Water User Group:

The City of Canton provides water service in Van Zandt County. The estimated population is 3,537 in the year 2010 and is projected to be 4,613 in the year 2060. The City relies on ground water from the Carrizo-Wilcox with a total pumping capacity of 180 GPM, or 97 ac-ft/yr and from Lake Canton with 706 ac-ft/yr. Canton is projected to have a water supply deficit of 120 ac-ft/yr beginning 2010 and increasing to a deficit of 349 ac-ft/yr by 2060. The system is bordered by Myrtle Springs WSC to the Northwest and Mac Bee WSC to the Southwest. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	3537	3795	4012	4175	4382	4613
Projected Water Demand	923	978	1020	1048	1095	1152
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	803	803	803	803	803	803
Projected Supply Surplus (+) / Deficit (-)	**-120**	**-175**	**-217**	**-245**	**-292**	**-349**

Evaluation of Potentially Feasible Water Management Strategies:

There were four alternative strategies considered to meet City of Canton water supply shortages as summarized in the table below. Advanced conservation was considered because the 238 gallon per capita per day use was above the 140 gpcpd threshold set by the water planning group. However, the projected savings is minimal in comparison to the predicted shortage and the cost of conservation is much higher than that of ground water. Water reuse was omitted because the City does not have a demand for non-potable water at this time. Surface water alternatives were not selected since the safe yield from the City Lake has all been allocated for City use. In addition, the City has indicated a preference to use ground water and is planning on drilling new wells. A ground water worksheet is included as Attachment B.

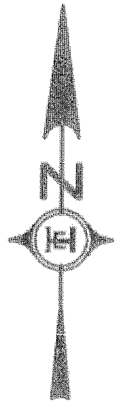
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation	**34**	**$223,586**	-	**$725**	**Minimal**
Water Reuse					
Ground Water	**387**	**$ 1,229,656**	**$ 150,596**	**$ 365**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	194	194	291	291	387	387

The recommended strategy for the City of Canton to meet their projected water deficit of 120 ac-ft in the year 2010 and 175 ac-ft in the year 2020 would be to construct two additional wells, similar to their existing well, with a capacity of 180 gpm each, or a total of 194 ac-ft/yr. With these additional wells, the City will still have a water shortage of 23 ac-ft in the year 2030 and increasing to 155 ac-ft in the year 2060. These shortages can be met by constructing two additional wells similar to the other wells. The recommended wells will be in the Carrizo-Wilcox aquifer in Van Zandt County.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendation previously discussed should be re-evaluated.



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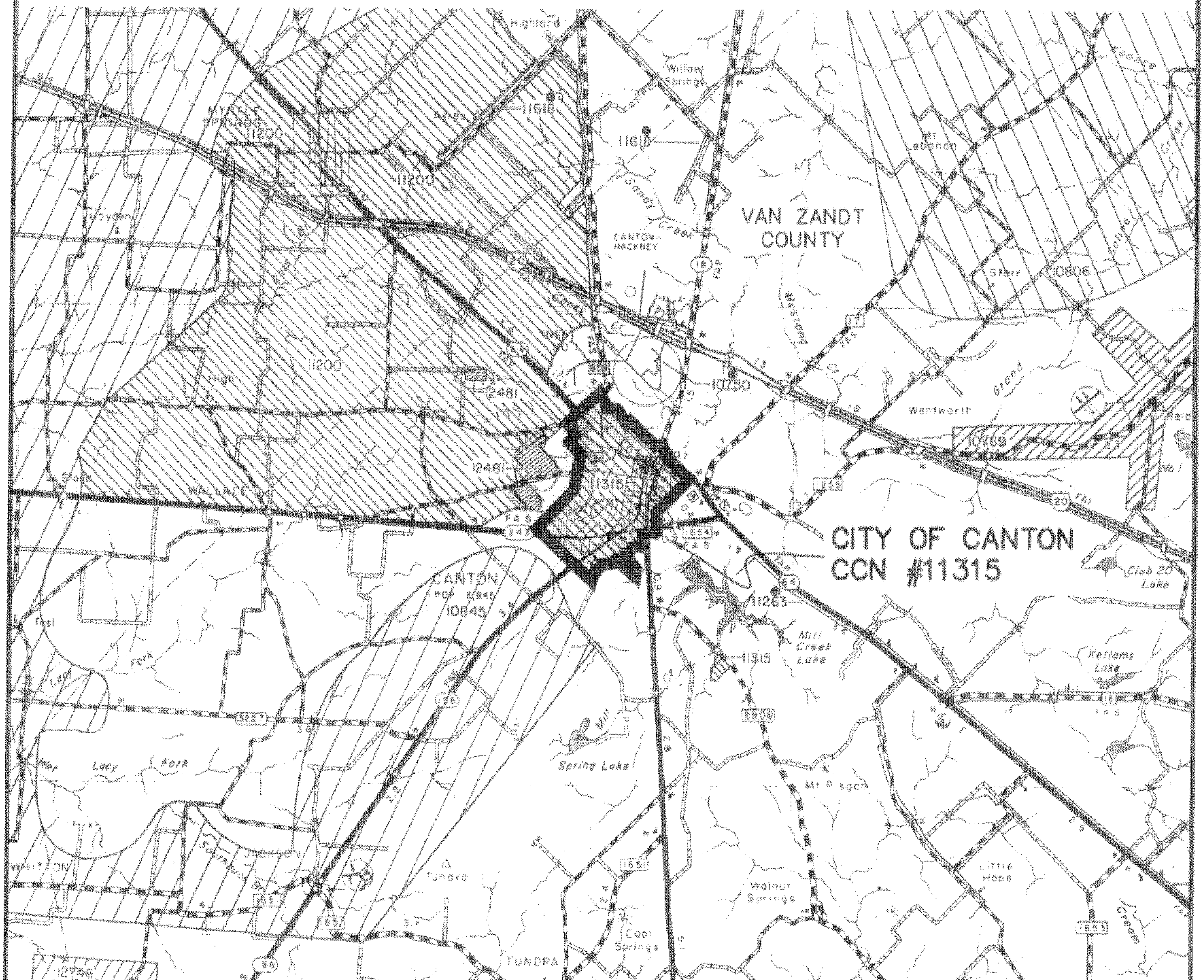


ATTACHMENT "A"
CITY OF CANTON
LOCATION MAP

Attachment B - Groundwater worksheet
City of Canton
Van Zandt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
4	560	180	**387**	$ 334.00	$ 748,160.00	$ 7,481.60	$ 755,641.60

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
10,000	6	$ 2.23	$ 133,800.00	$ 4,683.00	$ 138,483.00

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 894,124.60**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 268,237.38
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 1,182,361.98**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 70,941.72
4% Rate of Return on Investment of Unspent Funds	$ 23,647.24
Net Interest	**$ 47,294.48**
TOTAL CAPITAL COST	**$ 1,229,656.46**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 56,768.07

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	180	100	70%	4	0.06	$ 4,555.25

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 150,596.38**
WUG Total WMS Cost Per Acre-Foot	**$ 364.54**

Conservation Worksheet

Cost-Savings Analysis for Region D - City of Canton

Regional Data	
Population	4,086
SF Population	4,086
MF Population	-
Institutional Population	-
SF Units	1,634
MF Units	-
Average Yearly Rainfall (inches)	43.0
SF Household Size	2.50
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	-
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit	10.5	26.3	2.0	13.1	10%	50%	-	-	-	$ -	$ -	$ -	free or rebate
SF Showerheads and Aerators	5.5	13.8	2.0	6.9	10%	50%	-	-	-	$ -	$ -	$ -	kits picked up by customer
SF Clothes Washer Rebate	5.6	14.0	1.0	14.0	0%	90%	1,471	20,593	23.07	$ 120	$ 176,515	$ 815	rebate from water utility only
SF Irrigation Audit-High User	20.0	50.0	1.0	50.0	1%	5%	65	3,269	3.66	$ 70	$ 4,576	$ 459	staff
SF Rainwater Harvesting	18.9	47.3	1.0	47.3	0%	5%	82	3,866	4.33	$ 250	$ 20,430	$ 454	rebate
SF Rain Barrels	2.0	5.1	1.0	5.1	0%	30%	490	2,512	2.81	$ 45	$ 22,064	$ 756	rebate or distribution
MF Toilet Retrofit													
MF Showerheads and Aerators													
MF Clothes Washer Rebate													
MF Irrigation Audit													
MF Rainwater Harvesting													
								30,240	34		$ 223,586	$725.22	
Commercial													
Commercial Toilet Retrofit													
Coin-Operated Clothes Washer Rebate													
Irrigation Audit													
Commercial General Rebate													
Commercial Rainwater Harvesting													

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF GRAND SALINE

Description of Water User Group:

The City of Grand Saline provides water service in Van Zandt County. Grand Saline served a population of 3,028 in the year 2000. The population is projected to be 3,312 in 2010 and 4,560 in the year 2060. The City relies on four wells in the Carrizo-Wilcox aquifer with a total rated pumping capacity of 1,045 gpm, or 562 ac-ft/yr. The City is bounded by Golden WSC to the east, Pruitt-Sandflat WSC and Corinth WSC to the south, and Fruitvale WSC to the west. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	3312	3611	3863	4052	4292	4560
Projected Water Demand	627	671	705	731	769	817
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	562	562	562	562	562	562
Projected Supply Surplus (+) / Deficit (-)	**-65**	**-109**	**-143**	**-169**	**-207**	**-255**

Evaluation of Potentially Feasible Water Management Strategies:

There were four alternative strategies considered to meet City of Grand Saline's water supply shortages as summarized in the Table below. Advanced conservation was considered because the per capita use per day of 173 gpcd was above the 140 gpcd threshold set by the water planning group. Water reuse was omitted from consideration because there is no major user for the recycled supply. Surface water alternatives were considered. However the nearby WUG's with surface water surplus do not have adequate capacity for Grand Saline, and there is no regional entity in this vicinity. Groundwater and conservation worksheets are included as Attachment B and C respectively.

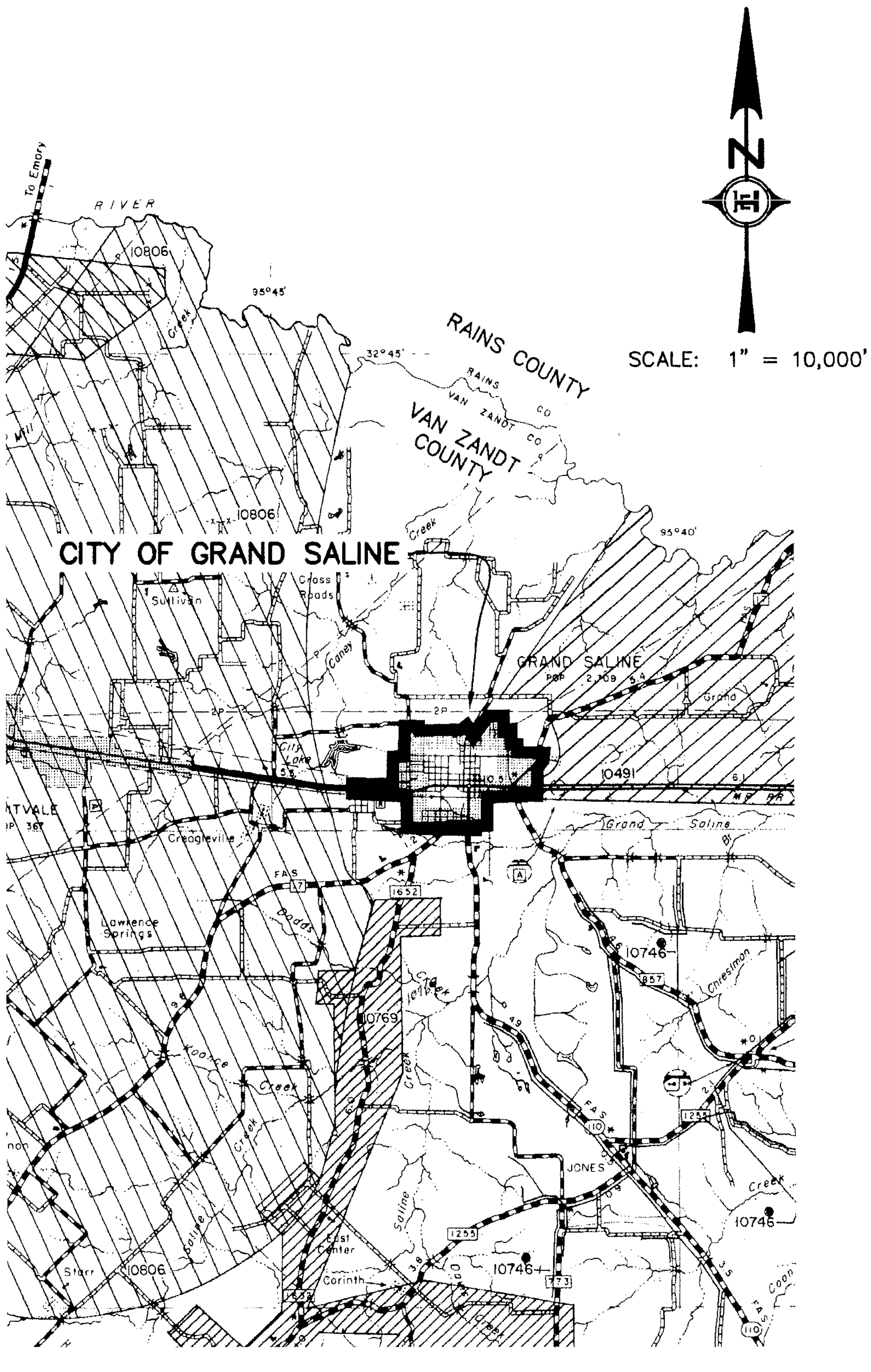
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation	**33**	**216,035**	-	**$725**	**Minimal**
Water Reuse					
Ground Water	**323**	**$574,243**	**$99,100**	**$323**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	161	161	161	323	323	323

The recommended strategy for the City of Grand Saline to meet their projected water deficit of 65 ac-ft in the year 2010 and 255 ac-ft in the year 2060 would be to construct two wells. The first well, 500 feet deep and with a pumping capacity of 300 gpm is currently under development and will replace existing well #2, for a net increase of 180 gpm, or 97 acre feet per year. A second well will be needed after 2015.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendation previously discussed should be re-evaluated.



ATTACHMENT "A"
CITY OF GRAND SALINE
LOCATION MAP

Attachment B - Groundwater worksheet
City of Grand Saline
Van Zandt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
2	500	300	**323**	$ 334.00	$ 334,000.00	$ 3,340.00	$ 337,340.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
5,200	6	$ 2.23	$ 69,576.00	$ 2,435.16	$ 72,011.16

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
-	-	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 409,351.16**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**

Other Capital Costs

ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)		$ 122,805.35
ENVIRONMENTAL (LUMP SUM)		$ 20,000.00
Total Borrowed Funds		**$ 552,156.51**
INTEREST DURING CONSTRUCTION(IDC):	6% Annual Interest on Total Borrowed Funds	$ 33,129.39
	4% Rate of Return on Investment of Unspent Funds	$ 11,043.13
	Net Interest	**$ 22,086.26**
TOTAL CAPITAL COST		**$ 574,242.77**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.51/ 1,000)		$ 53,614.29

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	300	100	70%	2	0.06	$ 3,796.04

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 99,100.35**
WUG Total WMS Cost Per Acre-Foot	**$ 323.37**

Conservation Worksheet

Cost-Savings Analysis for Region D - City of Grand Saline

Regional Data	
Population	3,948
SF Population	3,948
MF Population	-
Institutional Population	-
SF Units	1,579
MF Units	-
Average Yearly Rainfall (inches)	43.0
SF Houschold Size	2.50
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	-
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit	10.5	26.3	2.0	13.1	10%	50%	-	-	-	$ -	$ -	$ -	free or rebate
SF Showerheads and Aerators	5.5	13.8	2.0	6.9	10%	50%	-	-	-	$ -	$ -	$ -	kits picked up by customer
SF Clothes Washer Rebate	5.6	14.0	1.0	14.0	0%	90%	1,421	19,898	22.29	$ 120	$ 170,554	$ 815	rebate from water utility only
SF Irrigation Audit-High User	20.0	50.0	1.0	50.0	1%	5%	63	3,158	3.54	$ 70	$ 4,422	$ 459	staff
SF Rainwater Harvesting	18.9	47.3	1.0	47.3	0%	5%	79	3,736	4.18	$ 250	$ 19,740	$ 454	rebate
SF Rain Barrels	2.0	5.1	1.0	5.1	0%	30%	474	2,427	2.72	$ 45	$ 21,319	$ 756	rebate or distribution
MF Toilet Retrofit													
MF Showerheads and Aerators													
MF Clothes Washer Rebate													
MF Irrigation Audit													
MF Rainwater Harvesting													
								29,219	33		$ 216,035	$725.22	
Commercial													
Commercial Toilet Retrofit													
Coin-Operated Clothes Washer Rebate													
Irrigation Audit													
Commercial General Rebate													
Commercial Rainwater Harvesting													

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF RPM WATER SUPPLY CORPORATION

Description of Water User Group:

RPM WSC provides water services in southeast Van Zandt County. The system is projected to serve 1556 people in 2010 and 2610 people by the year 2060. The current sources of supply are four wells into the Carrizo Wilcox with a total production capacity of 440 gpm. RPM provides water to its own customers in the neches river basin and is projected to have a water supply deficit of 8 ac-ft/yr in 2020. The deficit is projected to increase to 99 ac-ft/yr by 2060. The system does have a water conservation plan and drought management plan in place. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	1556	1808	2021	2181	2384	2610
Projected Water Demand	216	245	267	283	307	336
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	237	237	237	237	237	237
Projected Supply Surplus (+) / Deficit (-)	**21**	**-8**	**-30**	**-46**	**-70**	**-99**

Evaluation of Potentially Feasible Water Management Strategies:

The four alternative strategies considered to meet RPM's water supply shortages are listed in the table below. Advanced conservation is not applicable since per capita use is less than 140 gpcpd. There are no significant water needs in RPM that could be met by water reuse. Surface water alternatives were omitted since there are no nearby entities with enough water to sale. Groundwater from the Woodbine Aquifer was the alternative selected for this entity.

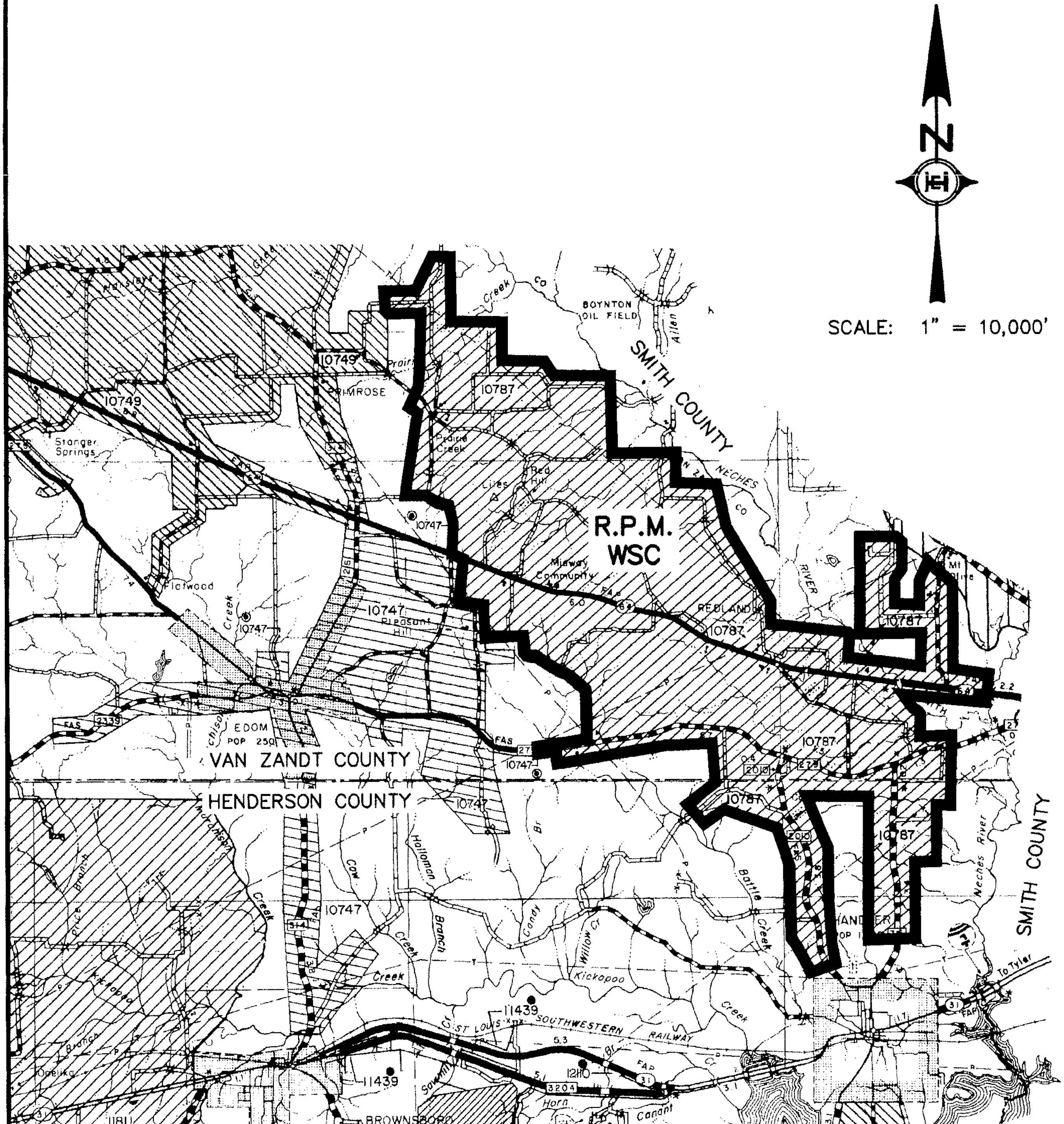
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annual Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**102**	**$574,243**	**$51,911**	**$491**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)		37	37	102	102	102

In their survey response, RPM stated that they had a documented plan to construct an additional well to provide 12 MG/yr (37 ac-ft/yr). Supply from this additional source should meet demand up to 2030. In order to meet the projected deficit after 2030, a new well with a rated capacity of 120 gpm should be drilled before 2040. This well will provide an additional 65 ac-ft/yr sufficient to meet the demand up to 2060.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendations previously discussed should be re-evaluated.



ATTACHMENT "A"
R.P.M. WSC
LOCATION MAP

Attachment B - Groundwater worksheet
RPM WSC
Van Zandt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
1	500	120	**65**	$ 334.00	$ 167,000.00	$ 1,670.00	$ 168,670.00
1	500	69	**37**	$ 334.00	$ 167,000.00	$ 1,670.00	$ 168,670.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
5,200	6	$ 2.23	$ 69,576.00	$ 2,435.16	$ 72,011.16

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
-	-	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 409,351.16**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 122,805.35
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 552,156.51**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 33,129.39
4% Rate of Return on Investment of Unspent Funds	$ 11,043.13
Net Interest	**$ 22,086.26**
TOTAL CAPITAL COST	**$ 574,242.77**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 9,461.34

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	120	100	70%	1	0.06	$ 759.21

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 51,910.58**
WUG Total WMS Cost Per Acre-Foot	**$ 490.51**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CORINTH WSC

Description of Water User Group:

Corinth WSC provides water service in Van Zandt County south of U.S.80 and north of I-20. In 2004, the WSC served 310 connections. The estimated population is 901 in the year 2010 and is projected to be 1,511 in year 2060. The system relies on three groundwater wells, which provide water from the Carrizo-Wilcox Aquifer with a total rated pumping capacity of 320 GPM or 172 ac-ft/yr. The system is projected to have a deficit of 6 ac-ft/yr in 2050 and increasing to a deficit of 23 ac-ft/yr in 2060. Corinth WSC is included in the County Other water user group for Van Zandt County. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	901	1047	1170	1263	1380	1511
Projected Water Demand	116	135	151	163	178	195
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	172	172	172	172	172	172
Projected Supply Surplus (+) / Deficit (-)	+56	+37	+21	+9	**-6**	**-23**

Evaluation of Potentially Feasible Water Management Strategies:

There were four alternative strategies considered to meet Corinth WSC water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was below 140 gpcd threshold set by the water planning group. Water reuse was omitted from consideration because the WSC does not have a centralized sewerage collection system. Surface water alternatives were omitted since there is not a supply source within close proximity to the WSC. A groundwater worksheet is included as Attachment B.

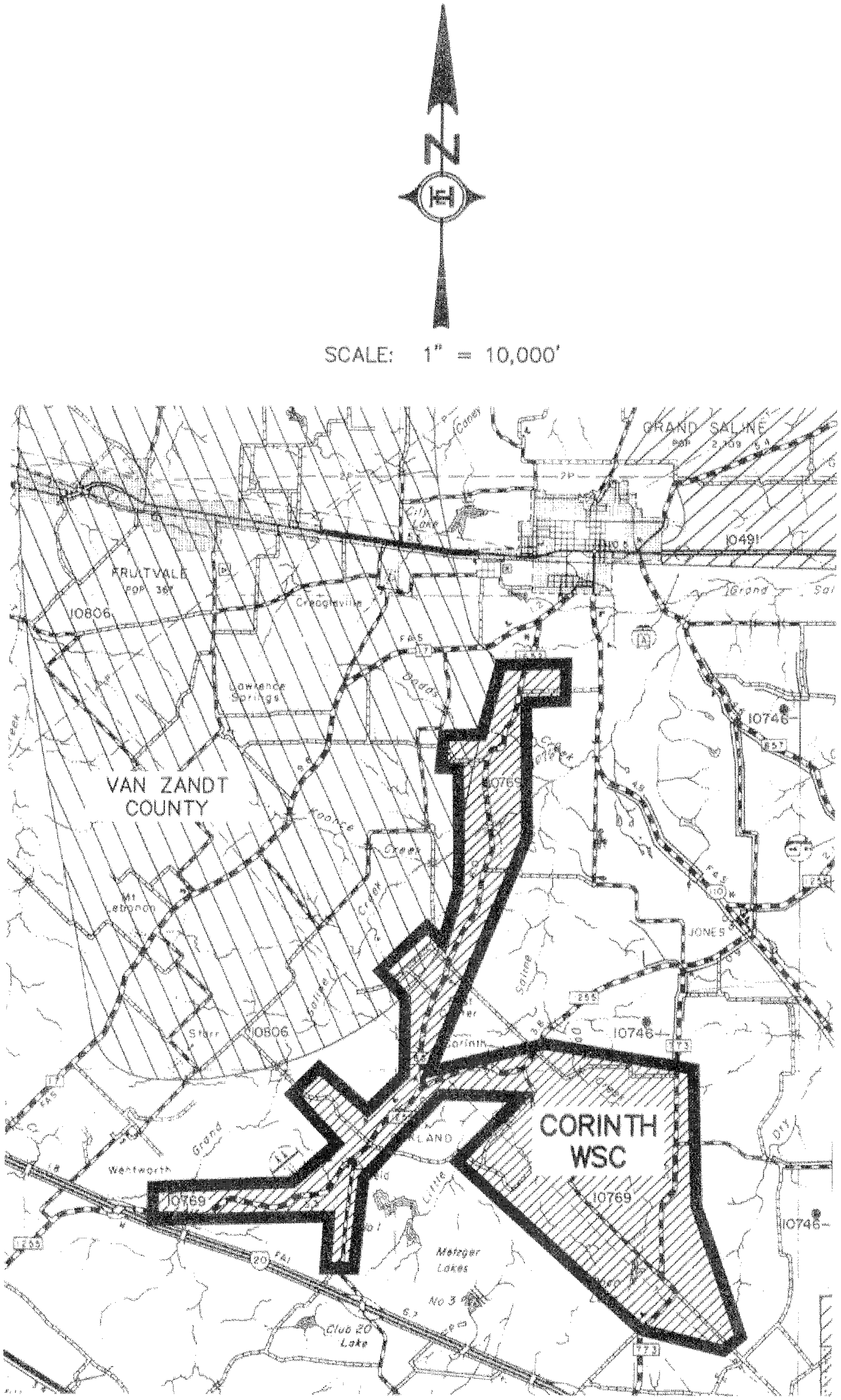
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**27**	**$281,295**	**$24,681**	**$1,371**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)					27	27

The recommended strategy for Corinth WSC to meet their projected deficit of 6 ac-ft in the year 2050 and 23 ac-ft in the year 2060 would be to construct one additional well in the Carrizo-Wilcox aquifer about 500 ft deep. A well with a total pumping capacity 50 gpm or 27 ac-ft/yr has sufficient capacity to meet their shortages through the year 2060.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendation previously discussed should be re-evaluated.



ATTACHMENT "A"
CORINTH WSC
LOCATION MAP

Attachment B - Groundwater worksheet
Corinth WSC
Van Zandt County
County Other category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
1	500	50	**27**	$ 334.00	$ 167,000.00	$ 1,670.00	$ 168,670.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,600	4	$ 2.23	$ 23,192.00	$ 811.72	$ 24,003.72

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
-	-	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 192,673.72**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 57,802.12
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 270,475.84**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 16,228.55
4% Rate of Return on Investment of Unspent Funds	$ 5,409.52
Net Interest	**$ 10,819.03**
TOTAL CAPITAL COST	**$ 281,294.87**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 3,942.23

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	50	100	70%	1	0.06	$ 316.34

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 24,680.57**
WUG Total WMS Cost Per Acre-Foot	**$ 1,371.14**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CROOKED CREEK WSC

Description of Water User Group:

Crooked Creek WSC provides water service in Van Zandt County. In 2004, the WSC served 265 connections. The estimated population is 717 in the year 2010 and is projected to be 1,204 in the year 2060. Crooked Creek WSC is included in the County Other water user group for Van Zandt County. The system relies on one well in the Carrizo-Wilcox aquifer with a total pumping capacity of 185 gpm, or 99 ac-ft/yr. The WSC is adjacent to rural roads between FM 859 and state highway 9. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	717	834	932	1006	1099	1204
Projected Water Demand	92	107	120	130	142	155
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	99	99	99	99	99	99
Projected Supply Surplus (+) / Deficit (-)	+7	**-8**	**-21**	**-31**	**-43**	**-56**

Evaluation of Potentially Feasible Water Management Strategies:

There were four alternative strategies considered to meet Crooked Creek WSC water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was below 140 gpcd threshold set by the water planning group. Water reuse was omitted because the WSC does not have a demand for non-potable water and there is no central wastewater treatment facility. The WSC is considering contracting with City of Canton for surface water. A ground water worksheet is included as Attachment B, and a surface water worksheet is included as Attachment C.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**59**	**$ 212,882**	**$24,824**	**$348**	**Minimal**
Surface Water	**56**	**$76,885**	**$45,966**	**$1,735**	**Minimal**

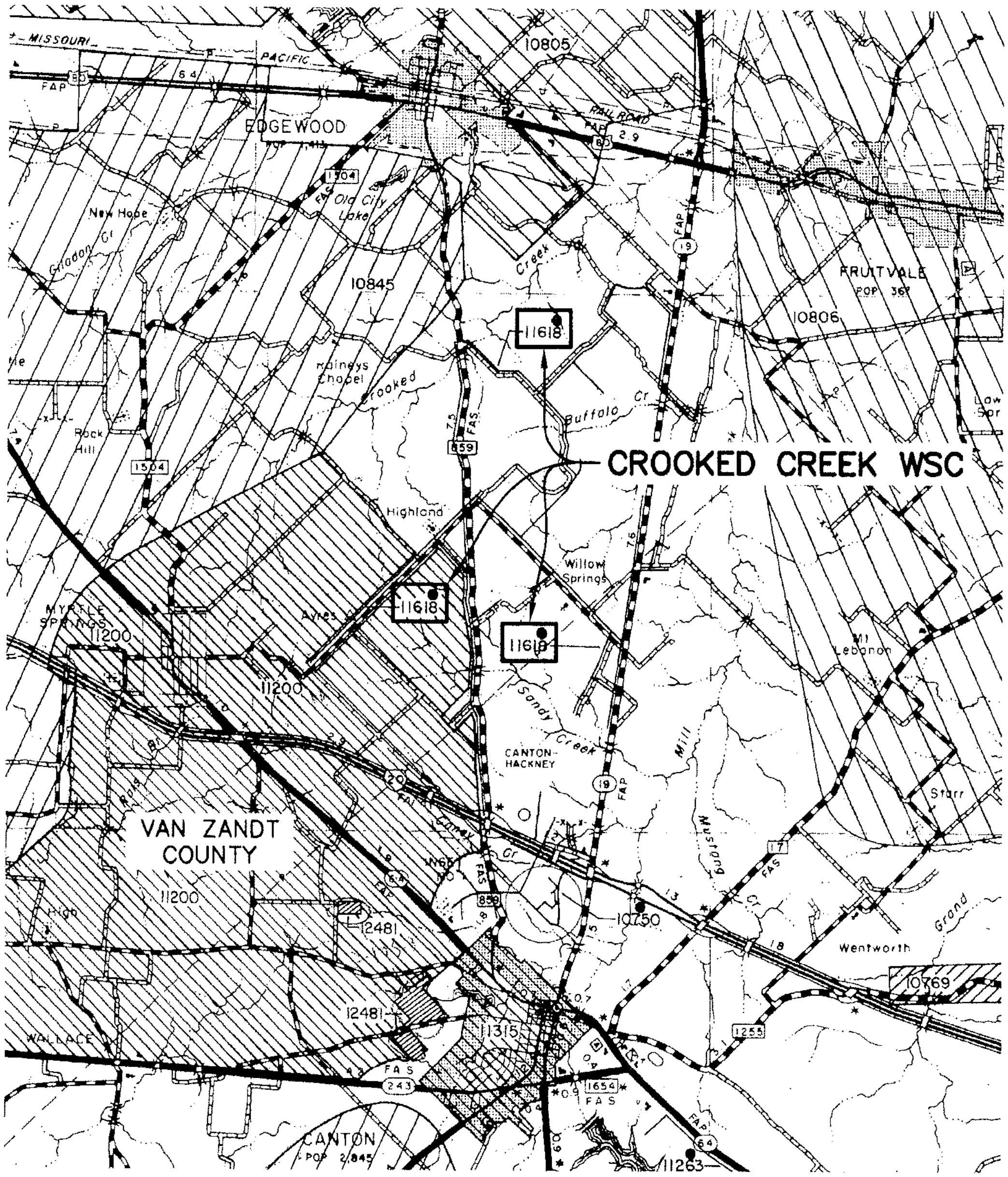
Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)		59	59	59	59	59

The recommended strategy for the Crooked Creek WSC would be to construct a groundwater well. The recommended supply source will be the Carrizo-Wilcox aquifer in Van Zandt County. A well with a rating of 110 gpm would provide approximately 59 acre-feet on an annualized basis. The WSC's total storage exceeds TCEQ requirements.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendation previously discussed should be re-evaluated.

SCALE: 1" = 10,000'



ATTACHMENT "A"
CROOKED CREEK WSC
LOCATION MAP

Attachment B - Groundwater worksheet
Crooked Creek WSC
Van Zandt County

Water Well Development

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
1	350	110	**59**	$ 334.00	$ 116,900.00	$ 1,169.00	$ 118,069.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,600	4	$ 2.23	$ 23,192.00	$ 811.72	$ 24,003.72

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
-	-	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 142,072.72**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 42,621.82
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 204,694.54**
INTEREST DURING CONSTRUCTIOI 6% Annual Interest on Total Borrowed Funds	$ 12,281.67
4% Rate of Return on Investment of Unspent Funds	$ 4,093.89
Net Interest	**$ 8,187.78**
TOTAL CAPITAL COST	**$ 212,882.32**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 8,672.90

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	110	100	70%	1	0.06	$ 695.94

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 24,824.10**
WUG Total WMS Cost Per Acre-Foot	**$ 347.72**

Attachment C - Surface Water worksheet
Crooked Creek WSC
Van Zandt County

Water Purchase Contract With City of Canton:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
49,994	**56.0**	$ 5.00

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
4,000	6	$ 1.67	$ 40,080.00	$ 1,402.80	$ 41,482.80

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost		**$ 41,482.80**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)		**1.0**
Other Capital Costs		
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)		$ 12,444.84
ENVIRONMENTAL (LUMP SUM)		$ 20,000.00
Total Borrowed Funds		**$ 73,927.64**
INTEREST DURING CONSTRUCTION(IDC):	6% Annual Interest on Total Borrowed Funds	$ 4,435.66
	4% Rate of Return on Investment of Unspent Funds	$ 1,478.55
	Net Interest	**$ 2,957.11**
TOTAL CAPITAL COST		**$ 76,884.75**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	8	21	31	43	56	27
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ 13,034.04	$ 34,214.36	$ 50,506.91	$ 70,057.97	$ 91,238.28	$ 43,175.26
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 5,581.83**	**$ 18,615.87**	**$ 39,796.19**	**$ 50,506.91**	**$ 70,057.97**	**$ 91,238.28**	**$ 45,966.17**

UNIT COST
($ / ac-ft / yr) **$ 1,734.57**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF EDOM WSC IN VAN ZANDT COUNTY

Description of Water User Group:

Edom WSC is included in the County Other water user group and provides water service in Van Zandt and Henderson Counties. In 2004, the WSC served a total of 470 connections. Approximately 78% of the population served resides in Van Zandt County. The estimated population in Van Zandt County is 1,056 in the year 2010 and is projected to be 1,771 in the year 2060. The system relies on four wells with a total pumping capacity of 340 gpm, or 183 ac-ft/yr. Edom WSC is planning a future well with a total pumping capacity of 80 to 120 gpm in the year 2006. In Van Zandt County, the system is projected to have a water supply deficit of 16 ac-ft/yr in 2020 and increasing to 86 ac-ft/yr in 2060. A location map is included in Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	1056	1227	1372	1480	1618	1771
Projected Water Demand	137	159	177	191	209	229
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	143	143	143	143	143	143
Projected Supply Surplus (+) / Deficit (-)	**6**	**-16**	**-34**	**-48**	**-66**	**-86**

Evaluation of Potentially Feasible Water Management Strategies:

There were four alternative strategies considered to meet Edom WSC water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was below 140 gpcd threshold set by the water planning group. Water reuse is not feasible because the WSC does not have a centralized sewerage collection system. Ground water was considered and a ground water worksheet is included as Attachment B. Surface water from the City of Tyler, which is 16 miles away, was also considered. A surface water worksheet is included as Attachment C.

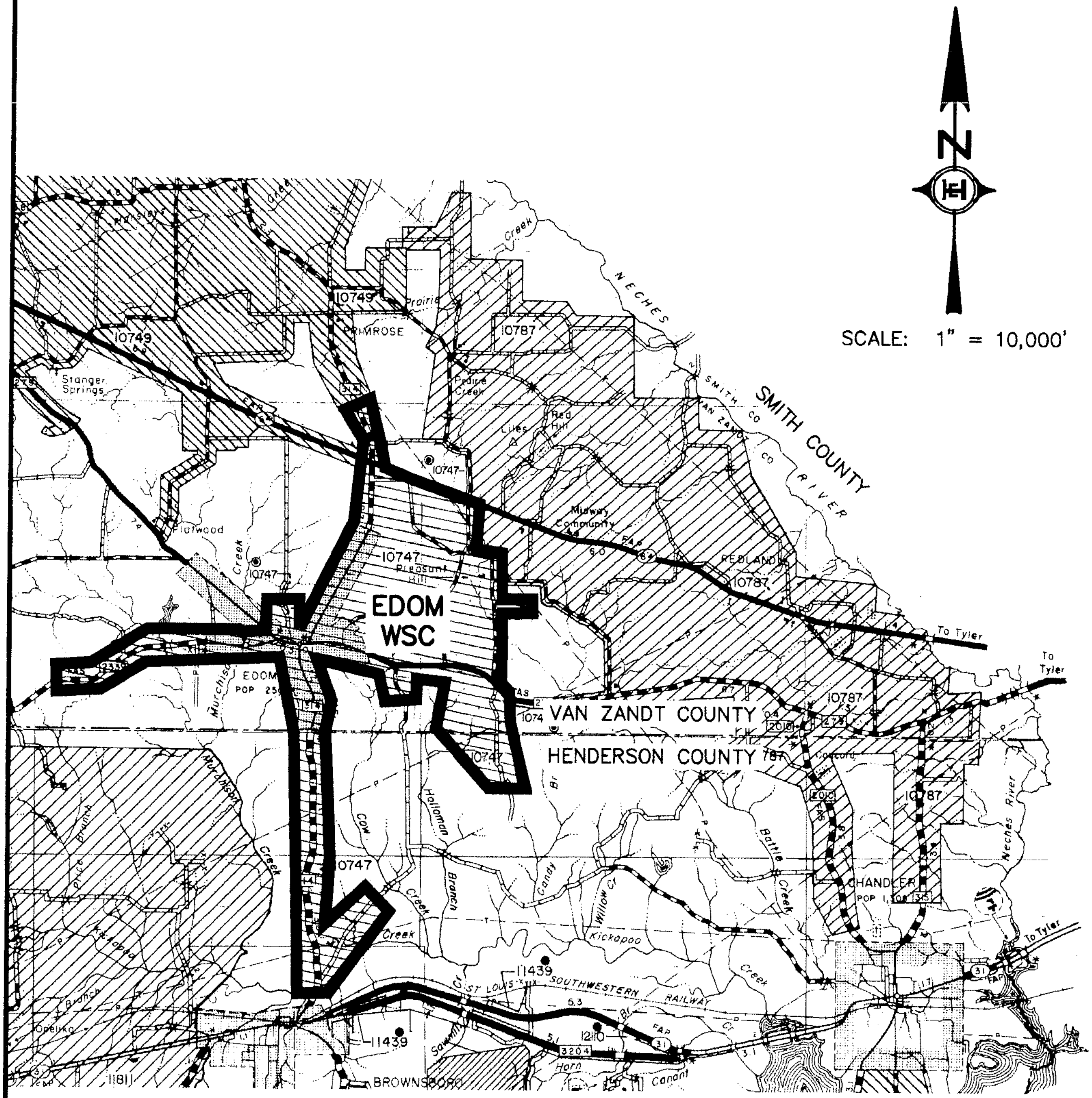
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**86**	**$ 661,715**	**$61,668**	**$657**	**Minimal**
Surface Water	**86**	**$1,983,766**	**$102,695**	**$2,465**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)		43	43	86	86	86

The recommended strategy for Edom WSC to meet their projected deficit of 86 ac-ft would be to construct one 80 gpm well, in addition to the 80 to 100 gpm well already in their plan. These two wells have a yield of 86 ac-ft/yr, sufficient to meet projected demand up to 2060. Edom WSC currently has a total storage that exceeds TCEQ requirements.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendation previously discussed should be re-evaluated.



ATTACHMENT "A"
EDOM WSC
LOCATION MAP

Attachment B - Groundwater worksheet
Edom WSC
Van Zandt County

Water well Development:

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
2	600	80	**86**	$ 334.00	$ 400,800.00	$ 4,008.00	$ 404,808.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
5,000	6	$ 2.23	$ 66,900.00	$ 2,341.50	$ 69,241.50

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
-	-	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 474,049.50**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 142,214.85
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 636,264.35**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 38,175.86
4% Rate of Return on Investment of Unspent Funds	$ 12,725.29
Net Interest	**$ 25,450.57**
TOTAL CAPITAL COST	**$ 661,714.92**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 12,615.13

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	80	100	70%	2	0.06	$ 1,012.28

TOTAL ANNUALIZED COST	**$ 61,667.91**
(O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	
WUG Total WMS Cost Per Acre-Foot	**$ 656.65**

Attachment C - Purchased Supply Worksheet
Edom WSC
Van Zandt County

Water Purchase Contract City of Tyler:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
76,776	**86.0**	$ 2.26

Pump Station

	Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
	0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
84,000	10	$ 1.67	$1,402,800.00	$ 49,098.00	$ 1,451,898.00

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost		**$ 1,451,898.00**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)		**1.0**
Other Capital Costs		
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)		$ 435,569.40
ENVIRONMENTAL (LUMP SUM)		$ 20,000.00
Total Borrowed Funds		**$ 1,907,467.40**
INTEREST DURING CONSTRUCTION(IDC):	6% Annual Interest on Total Borrowed Funds	$ 114,448.04
	4% Rate of Return on Investment of Unspent Funds	$ 38,149.35
	Net Interest	**$ 76,298.70**
TOTAL CAPITAL COST		**$ 1,983,766.10**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	16	34	48	66	86	42
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ 11,782.77	$ 25,038.39	$ 35,348.32	$ 48,603.94	$ 63,332.40	$ 30,684.30
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 144,021.42**	**$ 155,804.19**	**$ 169,059.81**	**$ 35,348.32**	**$ 48,603.94**	**$ 63,332.40**	**$ 102,695.01**

UNIT COST
($ / ac-ft / yr) **$ 2,464.68**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF FRUITVALE WSC

Description of Water User Group:

Fruitvale WSC provides water service in Van Zandt County. In 2004, the WSC served 1063 connections. The estimated population is 3,087 in the year 2010 and is projected to be 5,179 in the year 2060. Fruitvale WSC is included in the County Other water user group for Van Zandt County. The system relies on twelve wells into the Carrizo Wilcox with a total pumping capacity of 742 gpm, or 398 ac-ft/yr. The WSC is projected to have a deficit of 64 ac-ft/yr in 2020 and increasing to a deficit of 269 ac-ft/yr in 2060. A location map is included in Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	3087	3587	4010	4327	4730	5179
Projected Water Demand	398	462	517	557	609	667
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	398	398	398	398	398	398
Projected Supply Surplus (+) / Deficit (-)	+0	**-64**	**-119**	**-159**	**-211**	**-269**

Evaluation of Potentially Feasible Water Management Strategies:

There were four alternative strategies considered to meet Fruitvale WSC water supply shortages as summarized in the Table below. Advanced conservation was omitted because the per capita use per day was below 140 gpcd threshold set by the water planning group. Water reuse was not selected because the WSC does not have a centralized sewer collection system. Surface water alternatives were omitted since there is no viable supply source within close proximity to the WSC. The system plans to continue adding water wells, which are 500 feet deep and have an average capacity of 80 gpm to meet their requirements. A ground water worksheet is included as Attachment B.

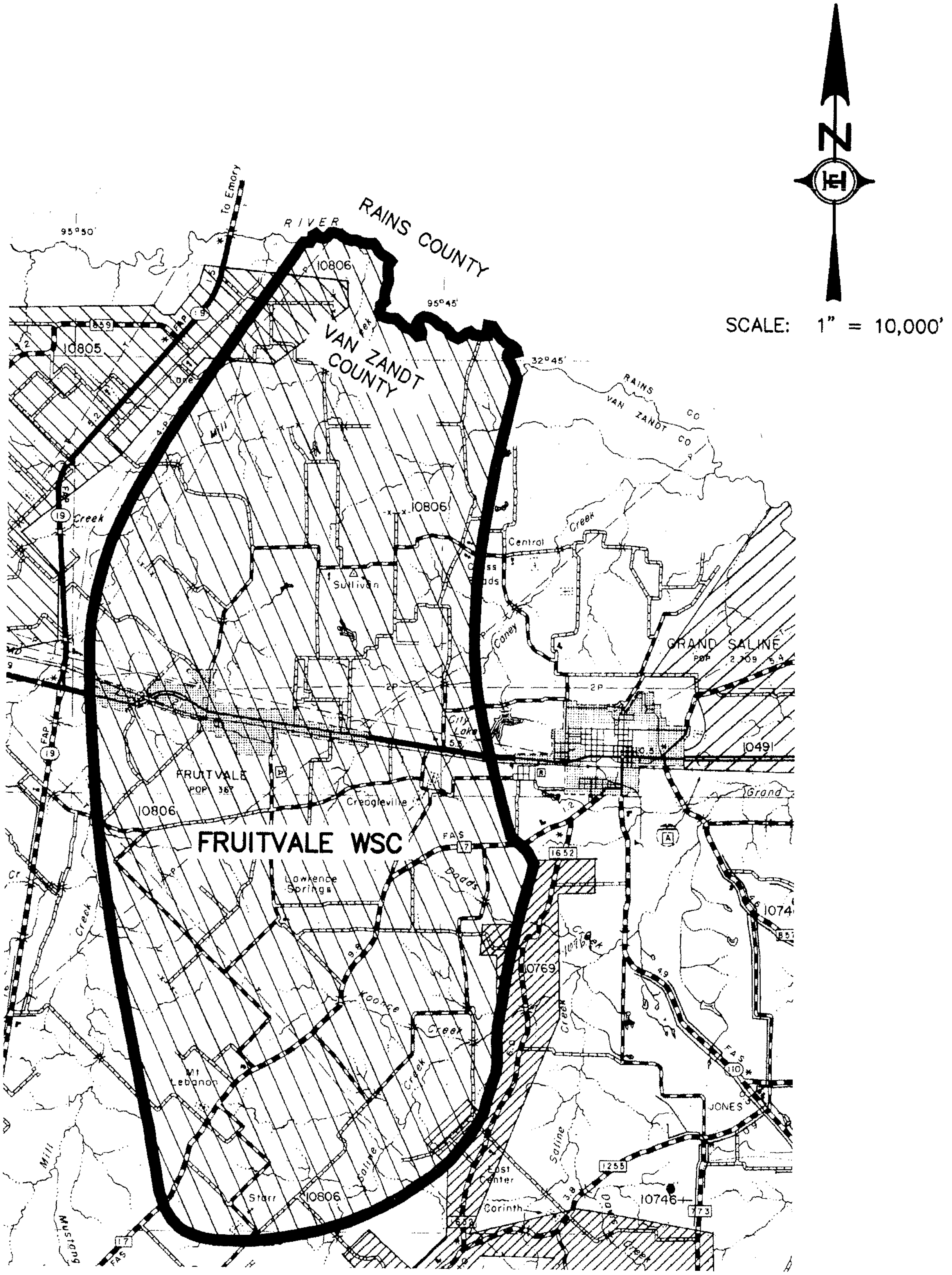
Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**301**	**$1,944,744**	**$190,656**	**$798**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)		86	129	172	215	301

The recommended strategy for Fruitvale WSC to meet their projected water deficit of 64 ac-ft in the year 2020 and 269 ac-ft in the year 2060 would be to construct seven additional 80 gpm, 43 ac-ft/yr, wells. It is recommended that two wells be constructed before 2020, followed by one well before 2030 and then one well around 2040. Additional wells should be constructed as needed. Fruitvale's existing total storage of 0.305 MG exceeds TCEQ requirements.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendation previously discussed should be re-evaluated.



ATTACHMENT "A"
FRUITVALE WSC
LOCATION MAP

Attachment B - Groundwater worksheet
Fruitvale WSC
Van Zandt County
County Other category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
7	500	80	**301**	$ 334.00	$ 1,169,000.00	$ 11,690.00	$ 1,180,690.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
17,500	6	$ 2.23	$ 234,150.00	$ 8,195.25	$ 242,345.25

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
-	-	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 1,423,035.25**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 426,910.58
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 1,869,945.83**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 112,196.75
4% Rate of Return on Investment of Unspent Funds	$ 37,398.92
Net Interest	**$ 74,797.83**
TOTAL CAPITAL COST	**$ 1,944,743.66**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 44,152.94

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	80	150	70%	7	0.06	$ 5,314.46

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 190,655.79**
WUG Total WMS Cost Per Acre-Foot	**$ 797.75**

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF LITTLE HOPE-MOORE WSC

Description of Water User Group:

Little Hope-Moore WSC provides water service in Van Zandt County. In 2004, the WSC served about 550 connections. The population of the WSC is estimated as 1,702 in 2010 and is projected to be 2,855 in the year 2060. Little Hope-Moore WSC is included in the County Other water user group for Van Zandt County. The system relies on five ground water wells, which provide water from the Carrizo-Wilcox Aquifer. The five wells have a total rated pumping capacity of 384 gpm, or 207 ac-ft/yr. The WSC is projected to have a water supply deficit of 13 ac-ft/yr in 2010 and increasing to 161 ac-ft/yr in 2060. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	1702	1978	2211	2386	2608	2855
Projected Water Demand	220	255	285	308	336	368
Water Demand from other entities	0	0	0	0	0	0
Current Water Supply	207	207	207	207	207	207
Projected Supply Surplus (+) / Deficit (-)	**-13**	**-48**	**-78**	**-101**	**-129**	**-161**

Evaluation of Potentially Feasible Water Management Strategies:

There were four alternative strategies considered to meet Little Hope-Moore WSC's water supply shortages as summarized in the Table below. Advanced conservation was not selected because the per capita use per day was below the 140 gpcd threshold set by the water planning group. Water reuse was not selected because the WSC does not have a centralized sewer collection system. Groundwater from the Carrizo Wilcox was also considered as an alternative for the WSC. Groundwater worksheet is included as Attachment B. Surface water alternative is included as Attachment C.

Strategy	Firm Yield (ac-ft)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation					
Water Reuse					
Ground Water	**188**	**$1,395,045**	**$135,877**	**$754**	**Minimal**
Surface Water	**161**	**$904,135**	**$145,651**	**$1,649**	**Minimal**

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	38	75	113	113	151	188

The recommended strategy for Little Hope-Moore WSC to meet their projected water deficit of 13 ac-ft in the year 2010 and 161 ac-ft in the year 2060 would be to drill additional wells. A 70 gpm well would yield approximately 38 ac-ft/yr, which is enough to meet needs in 2010. Four other wells of similar capacity should be drilled in successive decades to meet projected demands.

Given the increasing costs to comply with more stringent regulations and decreasing reliability of groundwater as a future supply source due to quality issues in this region, it is recommended that groundwater supply systems consider combining resources and/or soliciting future water supply from neighboring systems and/or major water providers in the region. If a feasible alternative becomes available, then the recommendation previously discussed should be re-evaluated.

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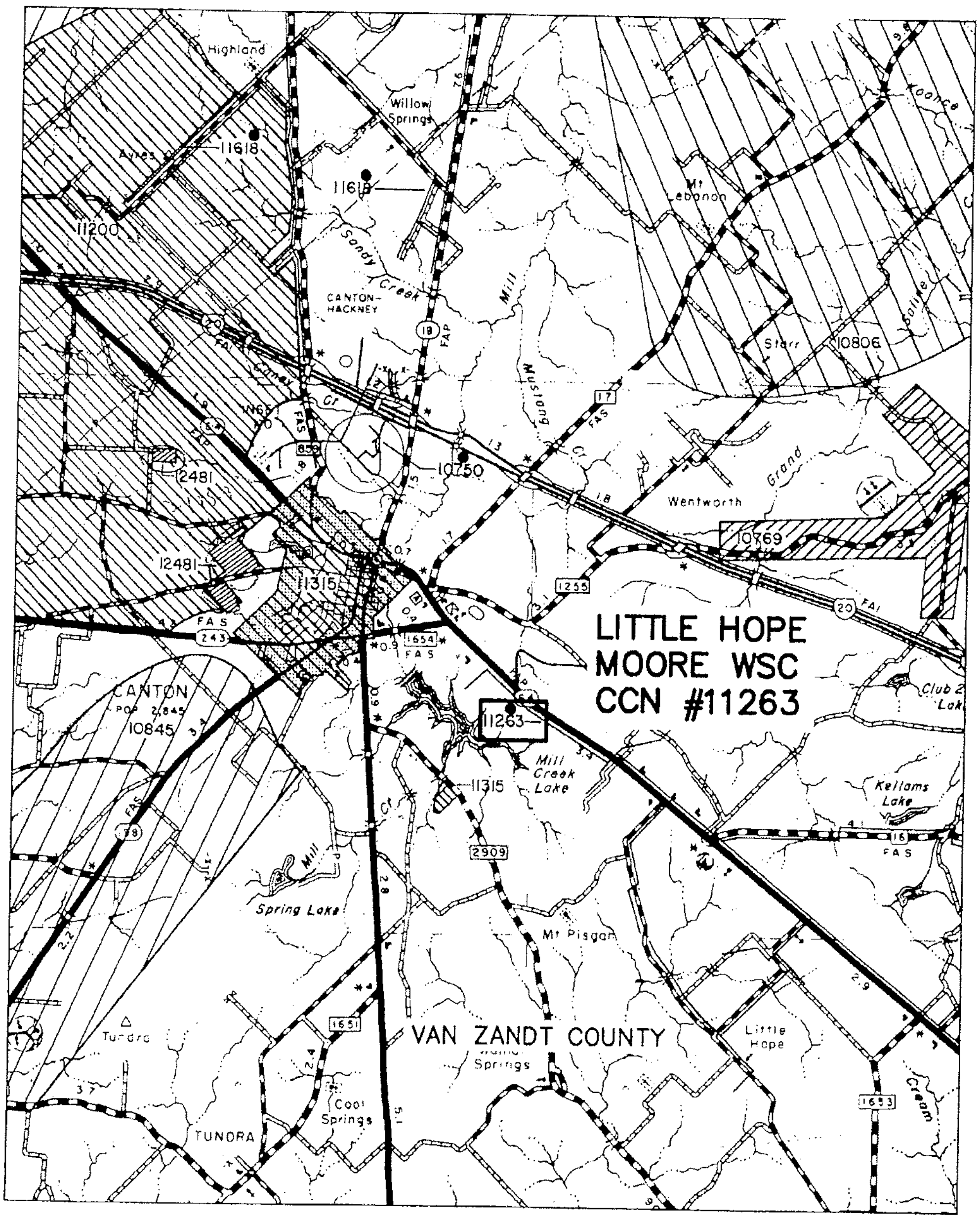
SCALE: 1" = 10,000'



ATTACHMENT "A"
LITTLE HOPE MOORE WSC
LOCATION MAP

Attachment B - Groundwater worksheet
Little Hope-Moore WSC
Van Zandt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
5	500	70	**188**	$ 334.00	$ 835,000.00	$ 8,350.00	$ 843,350.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
12,500	6	$ 2.23	$ 167,250.00	$ 5,853.75	$ 173,103.75

Storage

No of Tanks	Size-Gals	Cost per gallon		(1%)	Subtotal
-	-	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 1,016,453.75**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 304,936.13
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 1,341,389.88**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 80,483.39
4% Rate of Return on Investment of Unspent Funds	$ 26,827.80
Net Interest	**$ 53,655.60**
TOTAL CAPITAL COST	**$ 1,395,045.47**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.51/ 1,000)	$ 31,275.00

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	70	150	70%	5	0.06	$ 3,321.54

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 135,876.84**
WUG Total WMS Cost Per Acre-Foot	**$ 754.31**

NOTE: O&M costs include $0.06/1000 to sequester iron

Attachment C - Surface Water worksheet
Little Hope-Moore WSC
Van Zandt County

Water Purchase Contract With City of Edgewood:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
143,732	**161.0**	$ 3.92

Pump Station

	Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	Subtotal
	0	$ 176,000.00	$ -	$ -	$ -

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
63,000	6	$ 1.67	$ 631,260.00	$ 22,094.10	$ 653,354.10

Storage Tank

Number (ea)	Gallons (gal)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (1%)	Subtotal
-	0	$ 0.56	$ -	$ -	$ -

Total Construction Cost	**$ 653,354.10**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1.0**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 196,006.23
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 869,360.33**
INTEREST DURING CONSTRUCTION(IDC): 6% Annual Interest on Total Borrowed Funds	$ 52,161.62
4% Rate of Return on Investment of Unspent Funds	$ 17,387.21
Net Interest	**$ 34,774.41**
TOTAL CAPITAL COST	**$ 904,134.74**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	13	48	78	101	129	161	88
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 16,605.37	$ 61,312.12	$ 99,632.20	$ 129,010.93	$ 164,776.33	$ 205,651.08	$ 112,831.34
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 82,245.55**	**$ 126,952.31**	**$ 165,272.38**	**$ 129,010.93**	**$ 164,776.33**	**$ 205,651.08**	**$ 145,651.43**

UNIT COST
($ / ac-ft / yr) **$ 1,648.88**

REGION D
EVALUATIONS OF WATER MANAGEMENT STRATEGIES
FOR MEETING PROJECTED WATER SUPPLY NEEDS
TO YEAR 2060

WOOD COUNTY

WUGs:

City of Mineola

County Other:

City of Yantis

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF THE CITY OF MINEOLA

Description of Water User Group:

The City of Mineola is located in southwestern Wood County and serves the incorporated city limits and approximately 175 connections adjacent to the city. In 2003 the system had 2,123 residential connections. The population is projected to increase from 5,681 persons in 2010 to 6,858 persons in 2060. The City of Mineola is included in the City and County Other water user groups for Wood County. The system's current water supply consists of three water wells in the Carrizo-Wilcox Aquifer. The total rated capacity of these three wells is 1750 gpm, which equates to 941 ac-ft/yr on an annual average basis. The city provides 22 ac-ft/yr to the Manufacturing WUG in Wood County. The system is bounded on the north and west by Ramey WSC, on the east by New Hope WSC and on the south by the Sabine River. The City of Mineola does have a water conservation plan and a drought management plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	5681	6410	6814	6858	6858	6858
Projected Water Demand	1122	1237	1293	1286	1279	1279
Current Water Supply	919	919	919	919	919	919
Projected Supply Surplus (+)/Deficit(-)	**-203**	**-318**	**-374**	**-367**	**-360**	**-360**

Evaluation of Potentially Feasible Water Management Strategies:

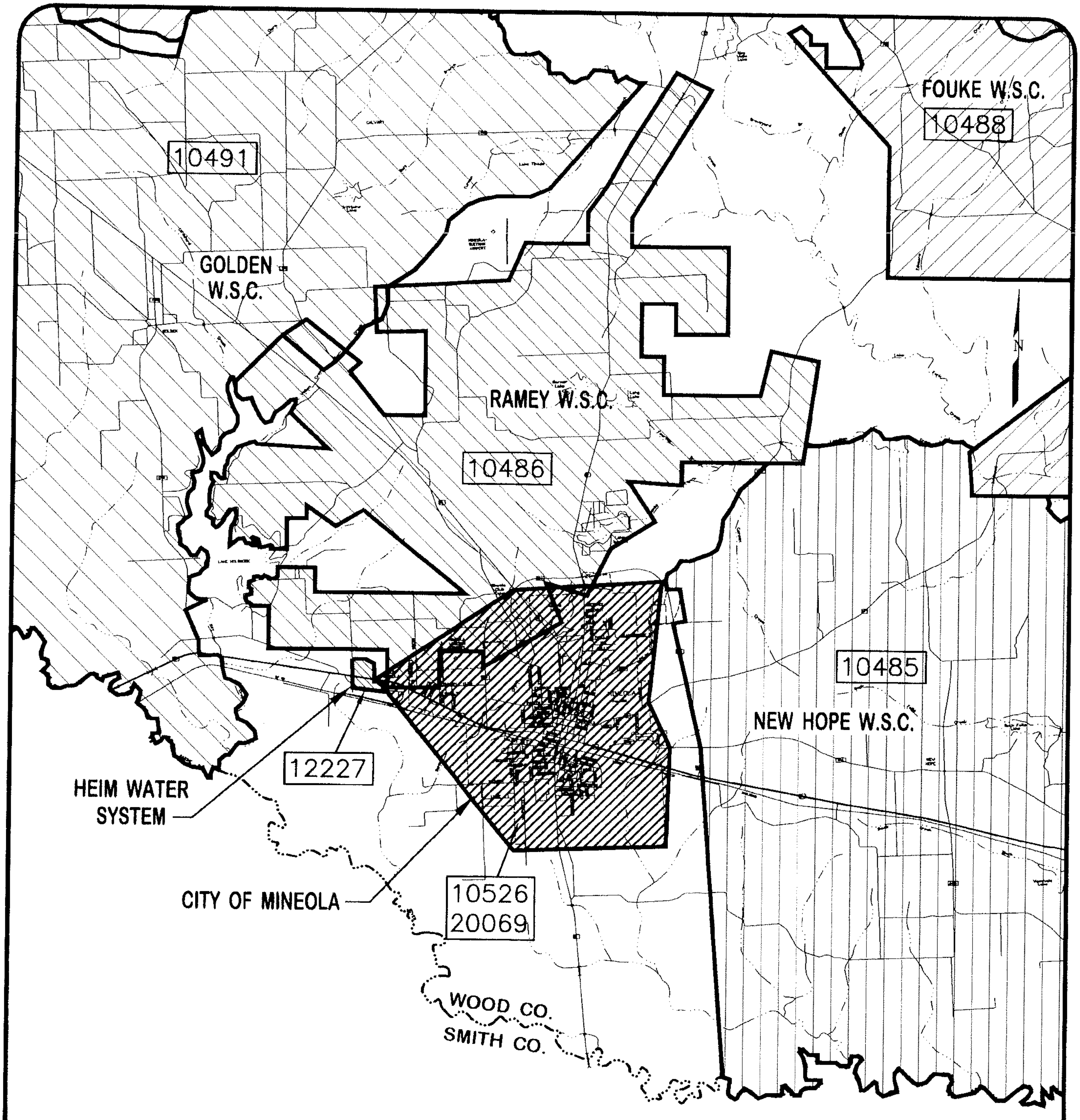
Four alternative strategies were considered to meet the City of Mineola's water supply shortages as summarized in the following table. Advanced conservation was considered because the per capita use per day of 184 is greater than the 140 gpcpd threshold set by the water planning group. Water reuse was omitted from consideration because the City does not have a demand for non-potable water at this time. Surface water alternatives were omitted since surface water treatment is not economically feasible for a system when groundwater is readily available. A groundwater worksheet is included as Attachment B and an advanced water conservation worksheet is included as Attachment C.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation	**49**	**$ 325,998**		**$ 726**	**Minimal**
Water Reuse					
Groundwater	**403**	**$ 243,334**	**$ 81,544**	**$ 202**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	403	403	403	403	403	403

Since the water conservation alternative does not provide sufficient savings to overcome the deficits, the recommended strategy for the City of Mineola to meet their projected deficit of 203 acre-feet in the year 2010 and 360 acre-feet in the year 2060 would be to construct one additional water well similar to their largest existing well. The recommended supply source will be the Carrizo-Wilcox Aquifer in Wood County. A well with rated capacity of 750 gpm would provide approximately 403 acre-feet on an annualized basis. The Carrizo-Wilcox Aquifer in Wood County is projected to have a more than ample supply availability to meet the needs of the City of Mineola for the planning period.



ATTACHMENT "A"

CITY OF MINEOLA
LOCATION MAP

Attachment B - Groundwater Worksheet
City of Mineola
Wood County
City and County Other Category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
1	400	750	**403**	$ 334.00	$ 133,600.00	$ 3,340.00	$ 136,940.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,000	8	$ 1.67	$ 26,720.00	$ 935.20	$ 27,655.20

Total Construction Cost	**$ 164,595.20**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 49,378.56
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
Total Borrowed Funds	**$ 233,974.76**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 14,038.49
4% Rate of Return on Investment of Unspent Funds	$ 4,679.50
Net Interest	**$ 9,358.99**
TOTAL CAPITAL COST	**$ 243,333.75**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 59,133.40

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	750	100	70%	1	0.06	$ 4,745.05

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 81,544.49**
WUG Total WMS Cost Per Acre-Foot	**$ 202.34**

City of Mineola Cost-Savings Analysis for Region D - Rural

Attachment C - Advanced Water Conservation Worksheet

WUG Data	
Population	6,270
SF Population	5,856
MF Population	282
Institutional Population	132
SF Units	2,371
MF Units	188
Average Yearly Rainfall (inches)	43.3
SF Household Size	2.47
MF Houshold Size	1.50
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	1.2
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	18
No. of MF Units per Complex	50

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit													
SF Showerheads and Aerators													
SF Clothes Washer Rebate	5.6	13.8	1.0	13.8	0%	90%	2,134	29,516	33.06	$ 120	$ 256,068	$ 825	rebate from water utility only
SF Irrigation Audit-High User	20.2	50.0	1.0	50.0	1%	5%	95	4,742	5.31	$ 70	$ 6,639	$ 459	staff
SF Rainwater Harvesting	19.3	47.6	1.0	47.6	0%	5%	119	5,648	6.33	$ 250	$ 29,638	$ 451	rebate
SF Rain Barrels	2.1	5.2	1.0	5.2	0%	30%	711	3,669	4.11	$ 45	$ 32,009	$ 750	rebate or distribution
MF Toilet Retrofit													
MF Showerheads and Aerators													
MF Clothes Washer Rebate	1.1	1.7	0.056	30.0	2%	80%	8	244	0.27	$ 120	$ 978	$ 553	rebate from water utility only
MF Irrigation Audit	1.7	2.5	NA	125.0	0%	50%	2	235	0.26	$ 150	$ 282	$ 393	staff
MF Rainwater Harvesting	7.4	11.1	NA	553.8	0%	5%	0	104	0.12	$ 2,050	$ 385	$ 318	rebate
								44,159	**49**		**$ 325,997.80**	**$ 726.36**	
Commercial													
Commercial Toilet Retrofit				26.0						$ 150		$ 365	free or rebate
Coin-Operated Clothes Washer Rebate				45.0	0%	50%				$ 170		$ 522	rebate from water utility only
Irrigation Audit				125.0						$ 150		$ 393	staff
Commercial General Rebate				1.0						$ 1.2		$ 103	rebate
Commercial Rainwater Harvesting				553.8						$ 2,050		$ 318	rebate

EVALUATION OF WATER MANAGEMENT STRATEGIES FOR MEETING THE PROJECTED WATER SUPPLY NEEDS OF CITY OF YANTIS

Description of Water User Group:

The City of Yantis is located in north central Wood County and serves an area north of Lake Fork within their city limits. In 2003 the system had 230 members. The population is projected to increase from 525 persons in 2010 to 637 persons in 2060. The City of Yantis is included in the County Other WUG for Wood County. The system's current water supply consists of three water wells from the Carrizo-Wilcox Aquifer. The total rated capacity of these wells is 122 gpm, or 66 ac-ft/yr. The system is bounded on the north, east, south, and west by Lake Fork WSC. City of Yantis does not have a water conservation plan, but does have a drought management plan. A location map is included as Attachment A.

Water Supply and Demand Analysis:

	2010	2020	2030	2040	2050	2060
Population	525	594	633	637	637	637
Projected Water Demand	74	82	86	85	84	84
Current Water Supply	66	66	66	66	66	66
Projected Supply Surplus(+)/Deficit(-)	**-8**	**-16**	**-20**	**-19**	**-18**	**-18**

Evaluation of Potentially Feasible Water Management Strategies:

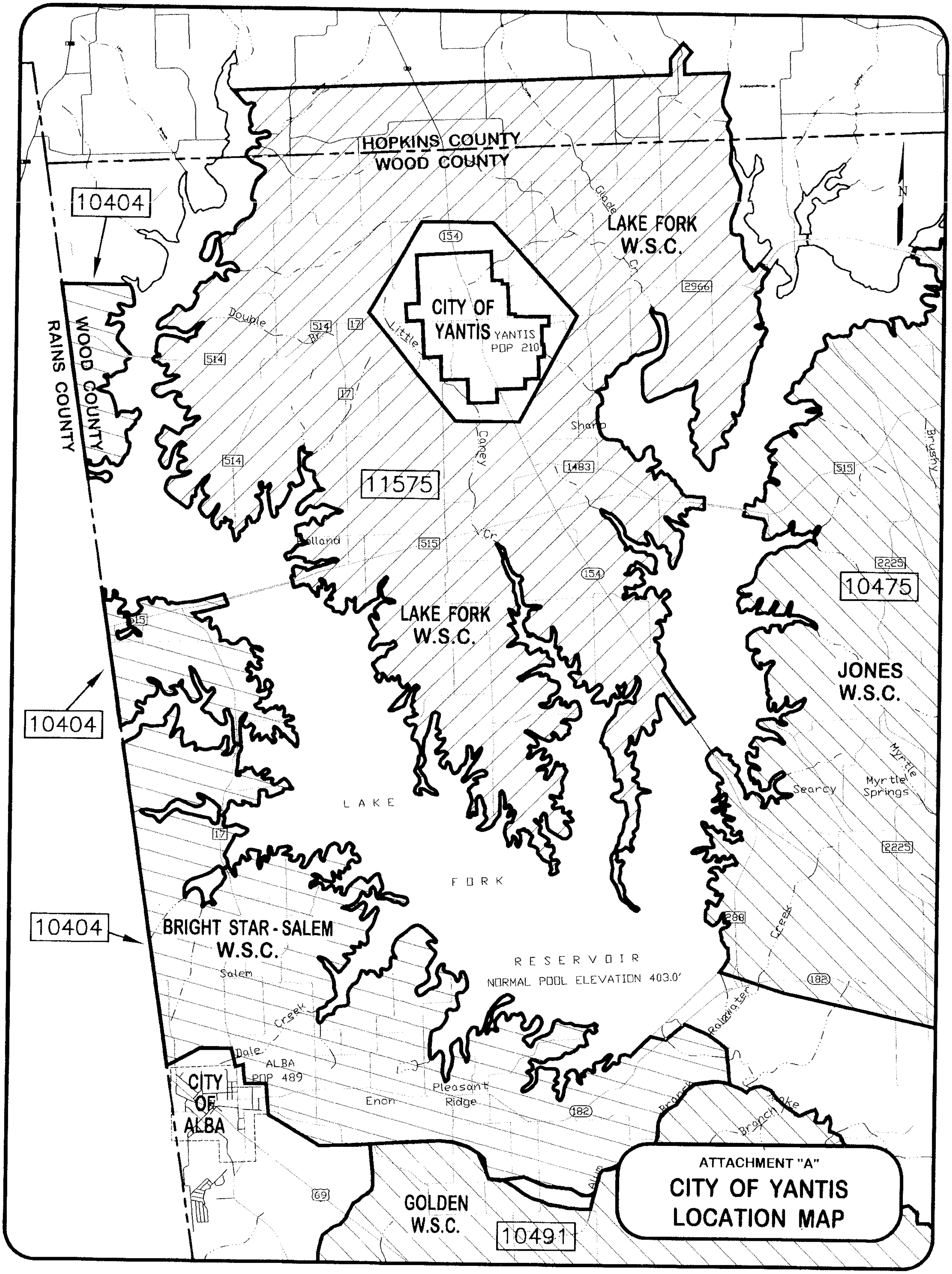
Four alternative strategies were considered to meet the City of Yantis' supply shortages as summarized in the following table. Advanced conservation was considered because the per capita use per day of 150 is greater than the 140 gpcpd threshold set by the water planning group. Water reuse was not considered because the City of Yantis does not have any users of recycled water. Surface water alternatives were not considered for the near term deficits since surface water treatment is not economically feasible for a system of this size. In addition, City of Yantis is constructing one new water well with expected completion in 2005. A groundwater worksheet is included as Attachment B and a worksheet for advanced water conservation is included as Attachment C. If surface water becomes available from the Lake Fork Reservoir this study should be re-evaluated.

Strategy	Firm Yield (AF)	Total Capital Cost	Total Annualized Cost	Unit Cost	Environmental Impact
Advanced Water Conservation	**5**	**$ 29,887**		**$ 726**	**Minimal**
Water Reuse					
Groundwater	**38**	**$ 227,734**	**$ 22,938**	**$ 603**	**Minimal**
Surface Water					

Recommendations:

	2010	2020	2030	2040	2050	2060
Groundwater (ac-ft/yr)	38	38	38	38	38	38

The recommended strategy for the City of Yantis to meet their projected deficit of 8 acre-feet in the year 2010 and 18 acre-feet in the year 2060 would be to construct one additional water well similar to their existing well. The recommended supply source will be the Carrizo-Wilcox Aquifer in Wood County. One well with rated capacity of 70 gpm would provide approximately 38 acre-feet on an annualized basis. The Carrizo-Wilcox Aquifer in Wood County is projected to have a more than ample supply availability to meet the needs of the City of Yantis for the planning period. The City of Yantis has received approval from TCEQ and should complete construction of the new well in 2005.



ATTACHMENT "A"
CITY OF YANTIS
LOCATION MAP

Attachment B - Groundwater Worksheet
City of Yantis
Wood County
County Other Category

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (2.5%)	Subtotal
1	400	70	**38**	$ 334.00	$ 133,600.00	$ 3,340.00	$ 136,940.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
4,000	4	$ 1.67	$ 26,720.00	$ 935.20	$ 27,655.20

Total Construction Cost	**$ 164,595.20**
Construction Duration ($0 to $3M =1YR, $3M to $5M = 1.5YRS, >5M=2YRS)	**1**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 49,378.56
ENVIRONMENTAL (LUMP SUM)	$ 5,000.00
Total Borrowed Funds	**$ 218,974.76**
INTEREST DURING CONSTRUCTION(IDC) 6% Annual Interest on Total Borrowed Funds	$ 13,138.49
4% Rate of Return on Investment of Unspent Funds	$ 4,379.50
Net Interest	**$ 8,758.99**
TOTAL CAPITAL COST	**$ 227,733.75**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,851 * $ 0.45/ 1,000)	$ 5,519.12

POWER COST	GPM	Head (ft)	Efficiency	No. of Wells	$/kWh	
	70	200	70%	1	0.06	$ 885.74

TOTAL ANNUALIZED COST (O & M Cost + Power Cost+ (Total Capital Cost* debt service factor (30 yrs @ 6%))	**$ 22,938.33**
WUG Total WMS Cost Per Acre-Foot	**$ 603.64**

City of Yantis Cost-Savings Analysis for Region D - Rural

Attachment C - Advanced Water Conservation Worksheet

WUG Data	
Population	544
SF Population	544
MF Population	-
Institutional Population	-
SF Units	218
MF Units	-
Average Yearly Rainfall (inches)	43.3
SF Household Size	2.49
MF Houshold Size	-
No. of Bathrooms per SF House	2.0
No. of Bathrooms per MF Unit	1.2
No of Irrigation Months	6
% of High Use SF customers	10%
No. of MF Units per Washer	-
No. of MF Units per Complex	-

Notes:
SF=single-family, MF=multi-family
Column 1 - savings per person in gallons per day
(For SF and MF Toilet Retrofits, Showers and Aerators and SF Clothes Washers see Section 2. For other measures, Column 1 is calculated by dividing Column 4 by the SF household size or the MF population using the measure.)
Column 2 - savings per housing unit in gallons per day
(Column 3 x Column 4, with the exception of MF Irrigation Audits and MF Rainwater Harvesting, which are calculated by multiplying Column 1 x MF household size.)
Column 3 - the number of measures needed for each living unit
Column 4 - gallons saved per day for each measure (see Section 2)
Column 5- the percent of customers that have already implemented this measure
Column 6- the potential number of customers who could be expected to implement the program with substantial marketing and outreach
Column 7- estimated number of measures [(column 6- column 5)*number of MF or SF units]
Column 8- potential savings for the region in gallons er day (column 4 x column 7)
Column 9- potential savings for the region in acre-feet [(column 8*365)/325851]
Column 10 - program costs including rebates, staff time and marketing (see Section 2)
Column 11- total program cost (column 7 x column 10)
Column 12 - cost per acre foot of water saved each year [(column 5 x 325,851 gallons/AF) / (column 4 x 365 days)]) amotized at 5% interest over the life of the measure
Column 13 - delivery option(s) for which costs are estimated

* See Sections 2 and 3 for additional information on calculations and assumptions

	For Participating Customers												
	Savings per Residential Capita (gpd)	Savings per Living Unit (gpd)	No. of Measures / Living Unit	Savings per Measure (gpd)	Current Penetration Rate	Potential Penetration Rate	Number of Proposed Measures	Potential Savings for the Region (gpd)	Potential Savings for the Region (acre-ft/yr)	Program Costs per Measure	Total Program Costs	Cost per AF of Water Saved (Amortized)	Standard Delivery Description
Residential	1	2	3	4	5	6	7	8	9	10	11	12	13
SF Toilet Retrofit													
SF Showerheads and Aerators													
SF Clothes Washer Rebate	5.6	13.9	1.0	13.9	0%	90%	197	2,742	3.07	$ 120	$ 23,595	$ 818	rebate from water utility only
SF Irrigation Audit-High User	20.1	50.0	1.0	50.0	1%	5%	9	437	0.49	$ 70	$ 612	$ 459	staff
SF Rainwater Harvesting	19.1	47.6	1.0	47.6	0%	5%	11	520	0.58	$ 250	$ 2,731	$ 451	rebate
SF Rain Barrels	2.1	5.2	1.0	5.2	0%	30%	66	338	0.38	$ 45	$ 2,949	$ 750	rebate or distribution
MF Toilet Retrofit	N/A												
MF Showerheads and Aerators	N/A												
MF Clothes Washer Rebate	N/A												
MF Irrigation Audit	N/A												
MF Rainwater Harvesting	N/A												
								4,037	5		$ 29,887.23	$ 726.13	
Commercial													
Commercial Toilet Retrofit	N/A												
Coin-Operated Clothes Washer Rebate	N/A												
Irrigation Audit	N/A												
Commercial General Rebate	N/A												
Commercial Rainwater Harvesting	N/A												

Socioeconomic Impacts of Unmet Water Needs in the Northeast Texas Regional Water Planning Area

Prepared by:

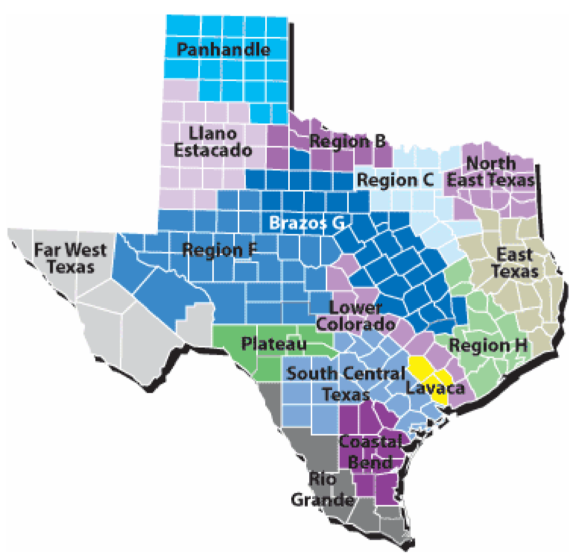
Stuart Norvell and Kevin Kluge of The Texas Water Development Board's Office of Water Resources Planning

Prepared in support of the:

Northeast Texas Water Planning Group and the 2006 Texas State Water Plan

May 2005

TEXAS WATER DEVELOPMENT BOARD



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Executive Summary

Background

Water shortages due to severe drought combined with infrastructure limitations would likely curtail or eliminate economic activity in business and industries heavily reliant on water. For example, without water farmers cannot irrigate; refineries cannot produce gasoline and paper mills cannot make paper. Unreliable water supplies would not only have an immediate and real impact on business and industry, but they might also bias corporate decision makers against plant expansion or plant location in Texas. From a societal perspective, water supply reliability is critical as well. Shortages would disrupt activity in homes, schools and government and could adversely affect public health and safety. For all of the above reasons, it is important to analyze and understand how restricted water supplies during drought could affect communities throughout the state.

Section 357.7(4) of the rules for implementing Texas Senate Bill 1 requires regional water planning groups to evaluate the social and economic impacts of projected water shortages (i.e., "unmet water needs") as part of the planning process. The rules contain provisions that direct the Texas Water Development Board (TWDB) to provide technical assistance to complete socioeconomic impact assessments. In response to requests from regional planning groups, staff of the TWDB's Office of Water Resources Planning designed and conducted analyses to evaluate socioeconomic impacts of unmet water needs.

Overview of Methodology

Two components make up the overall approach to this study: 1) an economic impact module and 2) a social impact module. Economic analysis addresses potential impacts of unmet water needs including effects on residential water consumers and losses to regional economies stemming from reductions in economic output for agricultural, industrial and commercial water uses. Impacts to agriculture, industry and commercial enterprises were estimated using regional "input-output" models commonly used by researchers to estimate how reductions in business activity might affect a given economy. Estimated impacts are *independent* and distinct "what if" scenarios for a given point in time (i.e., 2010, 2020, 2030, 2040, 2050 and 2060). Reported figures are scenarios that illustrate what could happen in a given year if: 1) water supply infrastructure and/or water management strategies do not change through time, 2) the drought of record recurs. Details regarding the methodology and assumptions for individual water use categories (i.e., municipal consumers including residential and commercial water users, manufacturing, steam-electric, mining, and agriculture) are in the main body of the report.

The social component focuses on demographic effects including changes in population and school enrollment. Methods are based on population projection models developed by the TWDB for regional and state water planning. With the assistance of the Texas State Data Center, TWDB staff modified these models and applied them for use here. Basically, the social impact module incorporates results from the economic impact module and assesses how changes in a region's economy due to water shortages could affect patterns of migration in a region.

Summary of Results

Table E-1 and Figure E-1 summarize estimated economic impacts. Variables shown include:[1]

- **sales** - economic output measured by sales revenue;
- **jobs -** number of full and part-time jobs required by a given industry including self-employment;
- **regional income -** total payroll costs (wages and salaries plus benefits) paid by industries, corporate income, rental income and interest payments for the region; and
- **business taxes -** sales, excise, fees, licenses and other taxes paid during normal operation of an industry (does not include any type of income tax).

If drought of record conditions return and water supplies are not developed, study results indicate that Region D could suffer significant losses. If such conditions occurred 2010 lost income to residents in the region could approach $135 million with associated job losses of 1,060. State and local governments could lose $23 million in tax receipts. If such conditions occurred in 2060, income losses could run $321 million and job losses could be as high 2,595. Nearly $50 million worth of state and local taxes would be lost. The majority of impacts stem from projected water shortages for manufacturing firms. Reported figures are probably conservative because they are based on estimated costs for a single year; but in much of Texas, the drought of record lasted several years. For example, in 2030 models indicate that shortages would cost residents and businesses in the region $175 million in lost income. Thus, if shortages lasted for three years total income losses related to unmet needs could easily approach $525 million.

Table E-1: Annual Economic Impacts of Unmet Water Needs
(years, 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Sales ($millions)	Income ($millions)	Jobs	State and Local Taxes ($millions)
2010	$163.97	$134.65	1,060	$22.58
2020	$178.69	$145.47	1,150	$23.93
2030	$228.12	$175.03	1,460	$27.44
2040	$270.88	$208.58	1,735	$32.68
2050	$340.95	$267.03	2,190	$42.23
2060	$404.47	$321.31	2,595	$50.02

* Impacts at the county level are in the main body of the report (see Attachment A). Source: Texas Water Development Board, Office of Water Resources Planning

[1] Total sales are not a good measure of economic prosperity because they include sales to other industries for further processing. For example, a farmer sells rice to a rice mill, which the rice mill processes and sells it to another consumer. Both transactions are counted in an input-output model. Thus, total sales "double count." Regional income plus business taxes are more suitable because they are a better measure of net economic returns.

Figure E-1: Distribution of Lost Income by Water Use Category
(years, 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

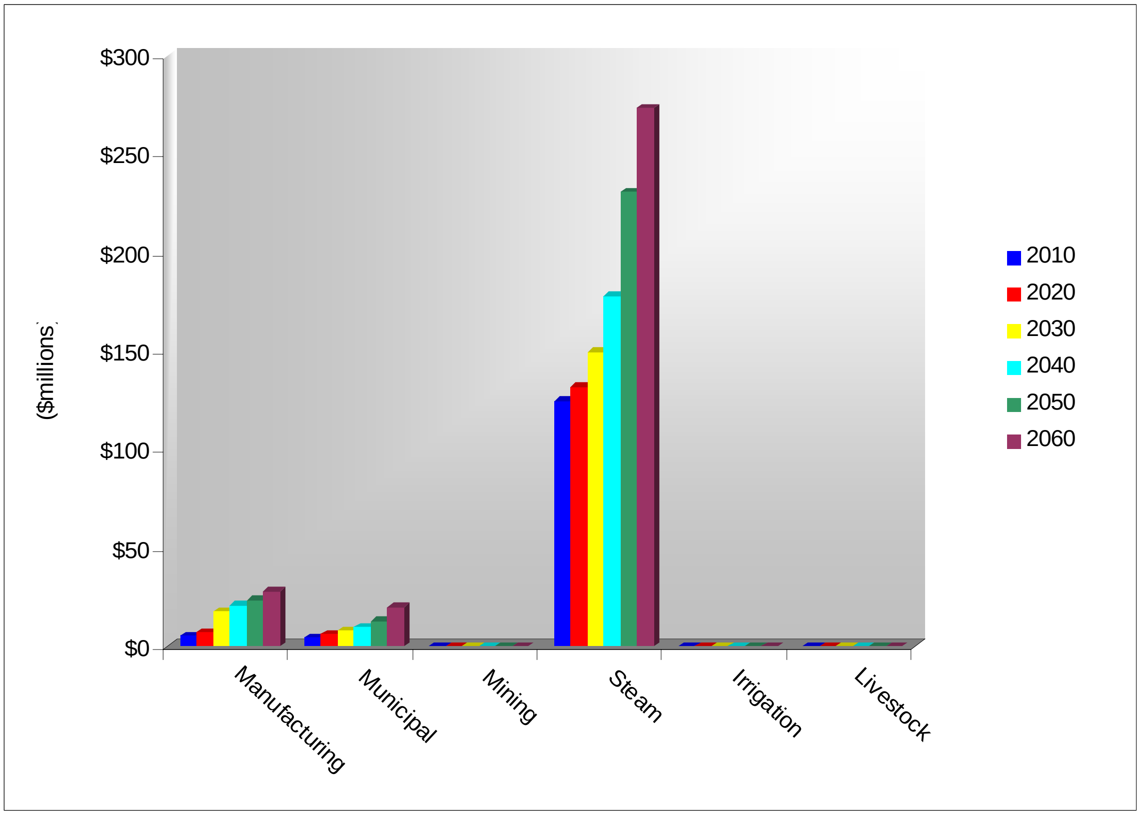

Table E-2 shows potential losses in population and school enrollment. Changes in population stem directly from the number of lost jobs estimated as part of the economic impact module. In other words, many – but not all – people would likely relocate due to a job loss and some have families with school age children. Section 1.3 in the main body of the report discusses methodology in detail.

Table E-2: Estimated Regional Social Impacts of Unmet Water Needs
(years, 2010, 2020, 2030, 2040, 2050 and 2060)

Year	Population Losses	Declines in School Enrollment
2010	1,850	480
2020	2,000	520
2030	2,540	650
2040	3,020	780
2050	3,810	980
2060	4,520	1,170

Source: Based on models developed by the Texas Water Development Board, Office of Water Resources Planning and the Texas State Data Center.

Introduction

Texas is one the nation's fastest growing states. From 1950 to 2000, population in the state grew from about 8 million to nearly 21 million. By the year 2050, the total number of people living in Texas is expected to reach 40 million. Rapid growth combined with Texas' susceptibility to severe drought makes water supply a crucial issue. If water infrastructure and water management strategies are not improved, Texas could face serious social, economic and environmental consequences - not only in our large metropolitan cities, but also on our farms and rural areas.

Water shortages due to severe drought combined with infrastructure limitations would likely curtail or eliminate economic activity in business and industries heavily reliant on water. For example, without water farmers cannot irrigate; refineries cannot produce gasoline and paper mills cannot make paper. Unreliable water supplies would not only have an immediate and real impact on business and industry, but they might also bias corporate decision makers against plant expansion or plant location in Texas. From a societal perspective, water supply reliability is critical as well. Shortages would disrupt activity in homes, schools and government and could adversely affect public health and safety. For all of the above reasons, it is important to analyze and understand how restricted water supplies during drought could affect communities throughout the state.

Section 357.7(4) of the rules for implementing Texas Senate Bill 1 requires regional water planning groups to evaluate the social and economic impacts of unmet water needs as part of the planning process. The rules contain provisions that direct the Texas Water Development Board (TWDB) to provide technical assistance to complete socioeconomic impact analyses. In response to requests from regional planning groups, TWDB staff designed and conducted required studies. The following document prepared by the TWDB's Office of Water Resources Planning summarizes analysis and results for the Region D Water Planning Area. Section 1 provides an overview of concepts and methodologies used in the study. Sections 2 and 3 provide detailed information and analyses for each water use category employed in the planning process (i.e., irrigation, livestock, municipal, manufacturing, mining and steam-electric).

1. Overview of Terms and Methodology

Section 1 provides a general overview of how economic and social impacts were measured. In addition, it summarizes important clarifications, assumptions and limitations of the study.

1.1 Measuring Economic Impacts

Economic analysis as it relates to water resources planning generally falls into two broad areas. Supply side analysis focuses on costs and alternatives of developing new water supplies or implementing programs that provide additional water from current supplies. Demand side analysis concentrates on impacts and benefits of providing water to people, businesses and the environment. Analysis in this report focuses strictly on demand side impacts. Specifically, it addresses the potential economic impacts of unmet water needs including: 1) losses to regional economies stemming from reductions in economic output, and 2) costs to residential water consumers associated with implementing emergency water procurement and conservation programs.

1.1.1 Impacts to Agriculture, Business and Industry

As mentioned earlier, severe water shortages would likely affect the ability of business and industry to operate resulting in lost output, which would adversely affect the regional economy. A variety tools are available to estimate such impacts, but by far, the most widely used today are input-output models (IO models) combined with social accounting matrices (SAMs). Referred to as IO/SAM models, these tools formed the basis for estimating economic impacts for agriculture (irrigation and livestock water uses) and industry (manufacturing, mining, steam-electric and commercial business activity for municipal water uses).

Basically, an IO/SAM model is an accounting framework that traces spending and consumption between different economic sectors including businesses, households, government and “foreign” economies in the form of exports and imports. As an example, Table 1 shows a highly aggregated segment of an IO/SAM model that focuses on key agricultural sectors in a local economy. The table contains transactions data for three agricultural sectors (cattle ranchers, dairies and alfalfa farms). Rows in Table 1 reflect sales from each sector to other local industries and institutions including households, government and consumers outside of the region in the form of exports. Columns in the table show purchases by each sector in the same fashion. For instance, the dairy industry buys $11.62 million worth of goods and services needed to produce milk. Local alfalfa farmers provide $2.11 million worth of hay and local households provide about $1.03 million worth of labor. Dairies import $4.17 million worth of inputs and pay $2.61 million in taxes and profits. Total economic activity in the region amounts to about $807.45 million. The entire table is like an accounting balance sheet where total sales equal total purchases.

Table 1: Example of a County-level Transaction and Social Accounting Matrix for Agricultural Sectors ($millions)

Sectors	Cattle	Dairy	Alfalfa	All other Industries	Taxes, govt. & profits	Households	Exports	Total
Cattle	$3.10	$0.01	$0.00	$0.03	$0.02	$0.06	$10.76	$13.98
Dairy	$0.07	$0.13	$0.00	$0.25	$0.01	$0.00	$11.14	$11.60
Alfalfa	$0.00	$2.11	$0.00	$0.01	$0.02	$0.01	$10.38	$12.53
Other industries	$2.20	$1.56	$2.90	$50.02	$70.64	$66.03	$48.48	$241.83
Taxes, govt. & profits	$2.37	$2.61	$5.10	$77.42	$0.23	$49.43	$83.29	$220.45
Households	$0.82	$1.03	$1.38	$50.94	$45.36	$7.13	$14.64	$121.30
Imports	$5.41	$4.17	$3.16	$63.32	$104.17	$5.53	$0.00	$185.76
Total	$13.97	$11.62	$12.54	$241.99	$220.45	$128.19	$178.69	$807.45

* Columns contain purchases and rows represent sales. Source: Adapted from Harris, T.R., Narayanan, R., Englin, J.E., MacDiarmid, T.R., Stoddard, S.W. and Reid, M.E. “*Economic Linkages of Churchill County.*” University of Nevada Reno. May 1993.

To understand how an IO/SAM model works, first visualize that $1 of additional sales of milk is injected into the dairy industry in Table 1. For every $1 the dairies receive in revenue, they spend 18 cents on alfalfa to feed their cows; nine cents is paid to households who provide farm labor, and another 13 cents goes to the category “other industries” to buy items such as machinery, fuel, transportation, accounting services etc. Nearly 22 cents is paid out in the form of profits (i.e., returns to dairy owners) and taxes/fees to local, state and federal government. The value of the initial $1 of revenue in the dairy sector is referred to as a first-round or **direct effect**.

As the name implies, first-round or direct effects are only part of the story. In the example above, alfalfa farmers must make 18 cents worth of hay to supply the increased demand for their product. To do so, they purchase their own inputs, and thus, they spend part of the original 18 cents that they received from the dairies on firms that support their own operations. For example, 12 cents is spent on fertilizers and other chemicals needed to grow alfalfa. The fertilizer industry in turn would take these 12 cents and spend them on inputs in its production process and so on. The sum of all re-spending is referred to as the **indirect effect** of an initial increase in output in the dairy sector.

While direct and indirect impacts capture how industries respond to a change, **induced impacts** measure the behavior of the labor force. As demand for production increases, employees in base industries and supporting industries will have to work more; or alternatively, businesses will have to hire more people. As employment increases, household spending rises. Thus, seemingly unrelated businesses such as video stores, supermarkets and car dealers also feel the effects of an initial change.

Collectively, indirect and induced effects are referred to as **secondary impacts**. In their entirety, all of the above changes (direct and secondary) are referred to as **total economic impacts**. By nature, total impacts are greater than initial changes because of secondary effects. The magnitude of the increase is what is popularly termed a multiplier effect. Input-output models generate numerical multipliers that estimate indirect and induced effects.

In an IO/SAM model impacts stem from changes in output measured by sales revenue that in turn come from changes in consumer demand. In the case of water shortages, one is not assuming a change in demand, but rather a supply shock – in this case severe drought. Demand for a product such as corn has not necessarily changed during a drought. However, farmers in question lack a crucial input (i.e., irrigation water) for which there is no *short-term* substitute. Without irrigation, she cannot grow irrigated crops. As a result, her cash flows decline or cease all together depending upon the severity of the situation. As cash flows dwindle, the farmer's income falls, and she has to reduce expenditures on farm inputs such as labor. Lower revenues not only affect her operation and her employees directly, but they also indirectly affect businesses who sell her inputs such as fuel, chemicals, seeds, consultant services, fertilizer etc.

The methodology used to estimate regional economic impacts consists of three steps: 1) develop IO/SAM models for each county in the region and for the region as whole, 2) estimate direct impacts to economic sectors resulting from water shortages, and 3) calculate total economic impacts (i.e., direct plus secondary effects).

Step 1*: Generate IO/SAM Models and Develop Economic Baseline*

IO/SAM models were estimated using propriety software known as IMPLAN PRO™ (Impact for Planning Analysis). IMPLAN is a modeling system originally developed by the U.S. Forestry Service in the late 1970s. Today, the Minnesota IMPLAN Group (MIG Inc.) owns the copyright and distributes data and software. It is probably the most widely used economic impact model in existence. IMPLAN comes with databases containing the most recently available economic data from a variety of sources.[2] Using IMPLAN software and data, transaction tables conceptually similar to the one discussed previously (see Table 1 on page 9) were estimated for

[2]The basic IMPLAN database consists of national level technology matrices based on the Benchmark Input-Output Accounts generated the U.S. Bureau of Economic Analysis and estimates of final demand, final payments, industry output and employment for various economic sectors. IMPLAN's regional data (i.e. states, a counties or groups of counties within a state) are divided into two basic categories: 1) data on an industry basis including value-added, output and employment and 2) data on a commodity basis including final demands and institutional sales. State-level data are balanced to the national totals using a matrix ratio allocation system and county data are balanced to state totals. In other words, much of the data in IMPLAN is based on a national average for all industries.

each county in the region and for the region as a whole. Each transaction table contains 528 economic sectors and allows one to estimate a variety of economic statistics including:

- **total sales -** total production measured by sales revenues;
- **intermediate sales -** sales to other businesses and industry within a given region;
- **final sales** – sales to end users in a region and exports out of a region;
- **employment -** number of full and part-time jobs (annual average) required by a given industry including self-employment;
- **regional income -** total payroll costs (wages and salaries plus benefits) paid by industries, corporate income, rental income and interest payments; and
- **business taxes -** sales, excise, fees, licenses and other taxes paid during normal operation of an industry (does not include income taxes).

TWDB analysts developed an economic baseline containing each of the above variables using year 2000 data. Since the planning horizon extends through 2060, economic variables in the baseline were allowed to change in accordance with projected changes in demographic and economic activity. Growth rates for municipal water use sectors (i.e., commercial, residential and institutional) are based on TWDB population forecasts. Projections for manufacturing, agriculture, and mining and steam-electric activity are based on the same underlying economic forecasts used to estimate future water use for each category. Monetary impacts in future years are reported in year 2000 dollars.

It is important to stress that employment, income and business taxes are the most useful variables when comparing the relative contribution of an economic sector to a regional economy. Total sales as reported in IO/SAM models are less desirable and can be misleading because they include sales to other industries in the region for use in the production of other goods. For example, if a mill buys grain from local farmers and uses it to produce feed, sales of both the processed feed and raw corn are counted as "output" in an IO model. Thus, total sales double-count or overstate the true economic value of goods and services produced in an economy. They are not consistent with commonly used measures of output such as Gross National Product (GNP), which counts only final sales.

Another important distinction relates to terminology. Throughout this report, the term *sector* refers to economic subdivisions used in the IMPLAN database and resultant input-output models (528 individual sectors based on Standard Industrial Classification Codes). In contrast, the phrase *water use category* refers to water user groups employed in state and regional water planning including irrigation, livestock, mining, municipal, manufacturing and steam electric. All sectors in the IMPLAN database were assigned to a specific water use category (see Attachment A of this report).

Step 2: *Estimate Direct Economic Impacts of Water Shortages*

As mentioned above, direct impacts accrue to immediate businesses and industries that rely on water. Without water industrial processes could suffer. However, output responses would likely vary depending upon the severity of a shortage. A small shortage relative to total water use may have a nominal effect, but as shortages became more critical, effects on productive capacity would increase.

For example, farmers facing small shortages might fallow marginally productive acreage to save water for more valuable crops. Livestock producers might employ emergency culling strategies, or they may consider hauling water by truck to fill stock tanks. In the case of manufacturing, a good example occurred in the summer of 1999 when Toyota Motor Manufacturing experienced water shortages at a facility near Georgetown, Kentucky. As water levels in the Kentucky River fell to historic lows due to drought, plant managers sought ways to curtail water use such as reducing rinse operations to a bare minimum and recycling water by funneling it from paint shops to boilers. They even considered trucking in water at a cost of 10 times what they were paying. Fortunately, rains at the end of the summer restored river levels, and Toyota managed to implement cutbacks without affecting production. But it was a close call. If rains had not replenished the river, shortages could have severely reduced output.[3]

Note that the efforts described above are not planned programmatic or long-term operational changes. They are emergency measures that individuals might pursue to alleviate what they consider a temporary condition. Thus, they are not characteristic of long-term management strategies designed to ensure more dependable water supplies such as capital investments in conservation technology or development of new water supplies.

To account for uncertainty regarding the relative magnitude of impacts to farm and business operations, the following analysis employs the concept of elasticity. Elasticity is a number that shows how a change in one variable will affect another. In this case, it measures the relationship between a percentage reduction in water availability and a percentage reduction in output. For example, an elasticity of 1.0 indicates that a 1.0 percent reduction in water availability would result in a 1.0 percent reduction in economic output. An elasticity of 0.50 would indicate that for every 1.0 percent of unavailable water, output is reduced by 0.50 percent and so on. Output elasticities used in this study are:[4]

- if unmet water needs are 0 to 5 percent of total water demand, no corresponding reduction in output is assumed;

- if water shortages are 5 to 30 percent of total water demand, for every 1.0 one percent of unmet need, there is a corresponding 0.25 percent reduction in output;

- if water shortages are 30 to 50 percent of total water demand, for every 1.0 one percent of unmet need, there is a corresponding 0.50 percent reduction in output; and

- if water shortages are greater than 50 percent of total water demand, for every 1.0 one percent of unmet need, there is a corresponding 1.0 percent (i.e., a proportional reduction).

Once output responses to water shortages were estimated, direct impacts to total sales, employment, regional income and business taxes were derived using regional level economic multipliers estimating using IO/SAM models. When calculating direct effects for the municipal, steam electric, manufacturing and livestock water use categories, sales to final demand were applied to avoid double counting impacts. The formula for a given IMPLAN sector is:

$$D_{i,t} = Q_{i,t} *_{,} S_{i,t} * E_Q * RFD_i * DM_{i(Q, L, I, T)}$$

where:

---

[3] See, Royal, W. "*High And Dry - Industrial Centers Face Water Shortages*." in Industry Week, Sept, 2000.

[4] Elasticities are based on one of the few empirical studies that analyze potential relationships between economic output and water shortages in the United States. The study, conducted in California, showed that a significant number of industries would suffer reduced output during water shortages. Using a survey based approach researchers posed two scenarios to different industries. In the first scenario, they asked how a 15 percent cutback in water supply lasting one year would affect operations. In the second scenario, they asked how a 30 percent reduction lasting one year would affect plant operations. In the case of a 15 percent shortage, reported output elasticities ranged from 0.00 to 0.76 with an average value of 0.25. For a 30 percent shortage, elasticities ranged from 0.00 to 1.39 with average of 0.47. For further information, see, California Urban Water Agencies, "*Cost of Industrial Water Shortages*." Prepared by Spectrum Economics, Inc. November, 1991.

$D_{i,t}$ = direct economic impact to sector *i* in period *t*

$Q_{i,t}$ = total sales for sector *i* in period *t* in an affected county

$RFD_{i,}$ = ratio of final demand to total sales for sector *i* for a given region

$S_{i,t}$ = water shortage as percentage of total water use in period *t*

E_Q = elasticity of output and water use

$DM_{i(L, I, T)}$ = direct output multiplier coefficients for labor (L), income (I) and taxes (T) for sector *i*.

Direct impacts to irrigation and mining are based upon the same formula; however, total sales as opposed to final sales were used. To avoid double counting, secondary impacts in sectors other than irrigation and mining (e.g., manufacturing) were reduced by an amount equal to or less than

Windows Media Player.lnk direct losses to irrigation and mining. In addition, in some instances closely linked sectors were moved from one water use category to another. For example, although meat packers and rice mills are technically manufacturers, in some regions they were reclassified as either livestock or irrigation. All direct effects were estimated at the county level and then summed to arrive at a regional figure. See Section 2 of this report for additional discussion regarding methodology and caveats used when estimating direct impacts for each water use category.

Step 3: *Estimate Secondary and Total Economic Impacts of Water Shortages*

As noted earlier, the effects of reduced output would extend well beyond sectors directly affected. Secondary impacts were derived using the same formula used to estimate direct impacts; however, regional level *indirect* and *induced* multiplier coefficients were applied and only final sales were multiplied.

1.1.2 Impacts Associated with Domestic Water Uses

IO/SAM models are not well suited for measuring impacts of shortages for domestic uses, which make up the majority of the municipal category.[5] To estimate impacts associated with domestic uses, municipal water demand and thus needs were subdivided into two categories – residential and commercial. Residential water is considered “domestic” and includes water that people use in their homes for things such as cooking, bathing, drinking and removing household waste and for outdoor purposes including lawn watering, car-washing and swimming pools. Shortages to residential uses were valued using a tiered approach. In other words, the more severe the shortage, the more costly it becomes. For instance, a 2 acre-foot shortage for a group of households that use 10 acre-feet per year would not be as severe as a shortage that amounted to 8 acre-feet. In the case of a 2 acre-foot shortage, households would probably have to eliminate some or all outdoor water use, which could have implicit and explicit economic costs including losses to the horticultural and landscaping industry. In the case of an 8 acre-foot shortage, people would have to forgo all outdoor water use and most indoor water consumption. Economic costs would be much higher in this case because people could probably not live with such a reduction,

[5] A notable exception is the potential impacts to the nursery and landscaping industry that could arise due to reductions in outdoor residential uses and impacts to “water intensive” commercial businesses (see Section 2.3.3).

and would be forced to find emergency alternatives. The alternative assumed in this study is a very uneconomical and worst-case scenario (i.e., hauling water in from other communities by truck or rail). Section 2.3.3 of this report discusses methodology for municipal uses in greater detail.

1.2 Measuring Social Impacts

As the name implies, the effects of water shortages can be social or economic. Distinctions between the two are both semantic and analytical in nature – more so analytic in the sense that social impacts are much harder to measure in quantitative terms. Nevertheless, social effects associated with drought and water shortages usually have close ties to economic impacts. For example, they might include:

- demographic effects such as changes in population,
- disruptions in institutional settings including activity in schools and government,
- conflicts between water users such as farmers and urban consumers,
- health-related low-flow problems (e.g., cross-connection contamination, diminished sewage flows, increased pollutant concentrations),
- mental and physical stress (e.g., anxiety, depression, domestic violence),
- public safety issues from forest and range fires and reduced fire fighting capability,
- increased disease caused by wildlife concentrations,
- loss of aesthetic and property values, and
- reduced recreational opportunities.[6]

Social impacts measured in this study focus strictly on demographic effects including changes in population and school enrollment. Methods are based on models used by the TWDB for state water planning and by the U.S. Census Bureau for national level population projections. With the assistance of the Texas State Data Center (TSDC), TWDB staff modified population projection models used for state water planning and applied them here. Basically, the social impact model incorporates results from the economic component of the study and assesses how changes in labor demand due to unmet water needs could affect migration patterns in a region. Before discussing particulars of the approach model, some background information regarding population projection models is useful in understanding the overall approach.

1.2.1 Overview of Demographic Projection Models

More often than not, population projections are reported as a single number that represents the size of an overall population. While useful in many cases, a single number says nothing about the composition of projected populations, which is critical to public officials who must make decisions regarding future spending on public services. For example, will a population in the future have more elderly people relative to today, or will it have more children? More children might mean that more schools are needed. Conversely, a population with a greater

[6] Based on information from the website of the National Drought Mitigation Center at the University of Nebraska Lincoln. Available online at: http://www.drought.unl.edu/risk/impacts.htm. See also, Vanclay, F. "*Social Impact Assessment*." in Petts, J. (ed) International Handbook of Environmental Impact Assessment. 1999.

percentage of elderly people may need additional healthcare facilities. When projecting future populations, cohort-survival models break down a population into groups (i.e., cohorts) based on factors such as age, sex and race. Once a population is separated into cohorts, one can estimate the magnitude and composition of future population changes.

Changes in a population's size and makeup in survival cohort models are driven by three factors:

1. *Births:* Obviously, more babies mean more people. However, only certain groups in a population are physically capable of bearing children– typically women between the ages of 13 and 49. The U.S. Census Bureau and the TSDC continually updates fertility rates for different cohorts. For each race/ethnicity category, birth rates decline and then stabilize in the future.

2. *Deaths:* When people die, populations shrink. Unlike giving birth, however, everyone is capable of dying and mortality rates are applied to all cohorts in a given population. Hence their name, cohort-survival models use survival rates as opposed to mortality rates. A survival rate is simply the probability that a given person with certain attributes (i.e., race, age and sex) will survive over a given period of time.

3. *Migration*: Migration is the movement of people in or out of a region. Migration rates used to project future changes in a region are usually based on historic population data. When analyzing historic data, losses or increases that are not attributed to births or deaths are assumed to be the result of migration. Migration can be further broken down into changes resulting from economic and non-economic factors. Economic migrants include workers and their families that relocate because of job losses (or gains), while non-economic migrants move due to lifestyles choices (e.g., retirees fleeing winter cold in the nation's heartland and moving to Texas).

In summary, knowledge of a population's composition in terms of age, sex and race combined with information regarding birth and survival rates, and migratory patterns, allows a great deal of flexibility and realism when estimating future populations. For example, an analyst can isolate population changes due to deaths and births from changes due to people moving in and out of a region. Or perhaps, one could analyze how potential changes in medical technology would affect population by reducing death rates among certain cohorts. Lastly, one could assess how changes in *economic conditions* might affect a regional population

1.2.2 Methodology for Social Impacts

Two components make up the model. The first component projects populations for a given year based on the following six steps:

1) *Separate "special" populations from the "general" population of a region:* The general population of a region includes the portion subject to rates of survival, fertility, economic migration and non-economic migration. In other words, they live, die, have children and can move in and out of a region freely. "Special populations," on the other hand, include college students, prisoners and military personnel. Special populations are treated differently than the general population. For example, fertility rates are not applied to prisoners because in general inmates at correctional facilities do not have children, and they are incapable of freely migrating or out of a region. Projections for special populations were compiled by the TSDC using data from the Higher Education Coordinating Board, the Texas Department of Criminal Justice and the U.S. Department of Defense. Starting from the 2000 Census, general and special populations were broken down into the following cohorts:

- age cohorts ranging from age zero to 75 and older,

• race/ethnicity cohorts, including Anglo, Black, Hispanic and “other,” and
• gender cohorts (male and female).

2) *Apply survival and fertility rates to the general population* : Survival and fertility rates were compiled by the TSDC with data from the Texas Department of Health (TDH). Natural decreases (i.e., deaths) are estimated by applying survival rates to each cohort and then subtracting estimated deaths from the total population. Birth rates were then applied to females in each age and race cohort in general and special populations (college and military only) to arrive at a total figure for new births.

3) *Estimate economic migration based on labor supply and demand*: TSDC year 2000 labor supply estimates include all non-disabled and non-incarcerated civilians between the ages of 16 and 65. Thus, prisoners are not included. Labor supply for years beyond 2001 was calculated by converting year 2000 data to rates according to cohort and applying these rates to future years. Projected labor demand was estimated based on historical employment rates. Differences between total labor supply and labor demand determines the amount of in or out migration in a region. If supply is greater than demand, there is an out-migration of labor. Conversely, if demand is greater than supply, there is an in-migration of labor. The number of migrants does not necessarily reflect total population changes because some migrants have families. To estimate how many people might accompany workers, a migrant worker profile was developed based on the U.S. Census Bureau’s Public Use Microdata Samples (PUMs) data. Migrant profiles estimate the number of additional family members, by age and gender that accompany migrating workers. Together, workers and their families constitute economic migration for a given year.

4) *Estimate non-economic migration*: As noted previously, migration patterns of individuals age 65 and older are generally independent of economic conditions. Retirees usually do not work, and when they relocate, it is primarily because of lifestyle preferences. Migratory patterns for people age 65 or older are based on historical PUMs data from the U.S. Census.

5) *Calculate ending population for a given year*: The total year-ending population is estimated by adding together: 1) surviving population from the previous year, 2) new births, 3) net economic migration, 4) net non-economic migration and 5) special populations. This figure serves as the baseline population for the next year and the process repeats itself.

The second component of the social impact model is identical to the first and includes the five steps listed above for each year where water shortages are reported (i.e., 2010, 2020, 2030, 2040, 2050 and 2060). The only difference is that labor demand changes in years with shortages. Shifts in labor demand stem from employment impacts estimated as part of the economic analysis component of this study with some slight modifications. IMPLAN employment data is based on the number of full and part-time jobs as opposed to the number of people working. To remedy discrepancies, employment impacts from IMPLAN were adjusted to reflect the number of people employed by using simple ratios (i.e., labor supply divided by number of jobs) at the county level. Declines in labor demand as measured using adjusted IMPLAN data are assumed to affect net economic migration in a given regional water planning area. Employment losses are adjusted to reflect the notion that some people would not relocate but would seek employment in the region and/or public assistance and wait for conditions to improve. Changes in school enrollment are simply the proportion of lost population between the ages of 5 and 17.

1.3 Clarifications, Assumptions and Limitations of Analysis

As with any attempt to measure and quantify human activities at a societal level, assumptions are necessary and every model has limitations. Assumptions are needed to maintain a level of generality and simplicity such that models can be applied on several geographic levels and across different economic sectors. In terms of the general approach used here several clarifications and cautions are warranted:

1) While useful for planning purposes, this study is not a benefit-cost analysis (BCA). BCA is a tool widely used to evaluate the economic feasibility of specific policies or projects as opposed to estimating economic impacts of unmet water needs. Nevertheless, one could include some impacts measured in this study as part of a BCA if done so properly.

2) Since this is not a BCA, future impacts are not weighted differently. In other words, estimates are not "discounted." If used as a measure of benefits in a BCA, one must consider the uncertainty of estimated monetary impacts.

3) All monetary figures are reported in constant year 2000 dollars.

4) Shortages reported by regional planning groups are the starting point for socioeconomic analyses. No adjustments or assumptions regarding the magnitude or distributions of unmet needs among different water use categories are incorporated in the analysis.

5) Estimated impacts are point estimates for years in which needs are reported (i.e., 2010, 2020, 2030, 2040, 2050 and 2060).They are independent and distinct "what if" scenarios for each particular year and water shortages are assumed to be temporary events resulting from severe drought conditions combined with infrastructure limitations. In other words, growth occurs and future shocks are imposed on an economy at 10-year intervals and resultant impacts are measured. Given, that reported figures are not cumulative in nature, it is inappropriate to sum impacts over the entire planning horizon. Doing so, would imply that the analysis predicts that drought of record conditions will occur every ten years in the future, which is not the case. Similarly, authors of this report recognize that in many communities needs are driven by population growth, and in the future total population will exceed the amount of water available due to infrastructure limitations, *regardless of whether or not there is a drought*. This implies that infrastructure limitations would constrain economic growth. However, since needs as defined by planning rules are based upon water supply and demand under the assumption of drought of record conditions, it improper to conduct economic analysis that focuses on growth related impacts over the planning horizon. Figures generated from such an analysis would presume a 50-year drought of record, which is unrealistic. Estimating lost economic activity related to constraints on population and commercial growth due to lack of water would require developing water supply and demand forecasts under "normal" or "most likely" future climatic conditions. *It is critical to stress that this is a modeling assumption necessary to maintain consistency with planning criteria, which states that water availability be evaluated assuming drought of record conditions. Analysis in this report does not predict that the drought of record will recur, nor does it predict or imply that growth will or should occur as projected.*

6) IO multipliers measure the strength of backward linkages to supporting industries (i.e., those who sell inputs to an affected sector). However, multipliers say nothing about forward linkages consisting of businesses that purchase goods from an affected sector for further processing. For example, ranchers in many areas sell most of their animals to local meat packers who process animals into a form that consumers ultimately see in grocery stores and restaurants. Multipliers do not capture forward linkages to meat packers, and since meat packers sell livestock purchased from ranchers as "final sales," multipliers for the ranching sector do fully account for all losses to a region's economy. Thus, as mentioned previously, in some cases closely linked sectors were moved from on water use category to another.

7) Cautions regarding interpretations of direct and secondary impacts are warranted. IO/SAM multipliers are based on "fixed-proportion production functions," which basically means that input use - including labor - moves in lockstep fashion with changes in levels of output. In a scenario where output (i.e., sales) declines, losses in the immediate sector or supporting sectors could be much less than predicted by an IO/SAM model for several

reasons. For one, businesses will likely expect to continue operating so they might maintain spending on inputs for future use; or they may be under contractual obligations to purchase inputs for an extended period regardless of external conditions. Also, employers may not lay-off workers given that experienced labor is sometimes scarce and skilled personnel may not be readily available when water shortages subside. Lastly people who lose jobs might find other employment in the region. As a result, direct losses for employment and secondary losses in sales and employment should be considered an *upper bound*. Similarly, since population projections are based on reduced employment in the region, they should be considered an upper bound as well.

8) IO models are static in nature. Models and resultant multipliers are based upon the structure of the U.S. and regional economies in the year 2000. In contrast, unmet water needs are projected to occur well into the future (i.e., 2010 through 2060). Thus, the analysis assumes that the general structure of the economy remains the same over the planning horizon.

9) With respect to municipal needs, an important assumption is that people would eliminate all outdoor water use before indoor water uses were affected, and people would implement emergency indoor water conservation measures before commercial businesses had to curtail operations, and households had to seek alternative sources of water. Section 2.3.3 discusses this in greater detail.

10) Impacts are annual estimates. If one were to assume that conditions persisted for more than one year, figures should be adjusted to reflect the extended duration. The drought of record in Texas for many communities lasted several years.

2. Economic Impacts

Part 2 of this report summarizes analysis for individual water use categories. Section 2.1 presents the year 2000 economic baseline for Region D. Section 2.2 summarizes results for agricultural water uses including livestock and irrigated crop production, while Section 2.3 reviews impacts to municipal and industrial water uses including manufacturing, mining, steam-electric and municipal demands.

2.1 Economic Baseline

Table 2 summarizes baseline economic variables for North East Texas WPA. In 2000, the region produced output valued at nearly $33.9 billion that generated about $16.0 billion worth of income and supported an estimated 358,544 jobs. Business and industry also generated slightly more than $1.3 billion in taxes for state and local governments. Sections 2.2.and 2.3 discuss contributions of individual water use categories in greater detail.

Table 2: Year 2000 Economic Baseline for Region D (monetary figures are in $millions)

	Sales Activity			Employment	Regional Income	Business Taxes
	Total	Intermediate	Final			
Crops	$158.50	$32.34	$126.16	10,635	$86.48	$7.43
% of Total	< 1%	< 1%	1%	3%	1%	1%
Livestock	$641.32	$391.96	$249.37	10046	$188.01	$6.18
% of Total	2%	4%	1%	3%	1%	0%
Manufacturing	$10,880.62	$1,484.45	$9,396.17	51749	$3,227.57	$110.02
% of Total	32%	17%	37%	14%	20%	8%
Mining	$2,400.46	$627.97	$1,772.49	4260	$920.87	$138.12
% of Total	7%	7%	7%	1%	6%	10%
Steam Electric	$596.30	$154.60	$441.70	1,040	$426.40	$76.40
% of Total	2%	2%	2%	0%	3%	6%
Municipal*	$19,193.46	$6,120.12	$13,073.35	280809	$10,982.31	$985.65
% of Total	57%	69%	52%	78%	69%	74%
Total	$33,870.67	$8,811.44	$25,059.23	358,544	$15,831.68	$1,323.78
% of Total	100%	100%	100%	100%	100%	100%

* Municipal includes all non-industrial commercial enterprises and institutional water uses such as the military, schools and other government organizations. Source: Generated by the Texas Water Development Board, Office of Water Planning using IMPLAN models and data from MIG, Inc.

2.2 Agriculture

2.2.1 Impacts to Irrigation

No water shortages associated with irrigation were reported for Region D.

2.2.2 Impacts to Livestock

No water shortages associated with the livestock industry were reported for Region D.

2.3 Municipal and Industrial Uses

Municipal and industrial (M&I) water uses make up the majority of economic activity in the Northeast Texas WPA. In 2000, M&I users generated over 95 percent of all sales, income, business taxes, supported accounted for about 93 percent all jobs in the region.

2.3.1 Manufacturing

Table 3 summarizes baseline economic data for manufacturing sectors in the Northeast Texas WPA. Aircraft manufacturing, poultry processing and industrial chemicals are by far the leaders with total sales of nearly $2.2 billion. In 2000, these three sectors supported about 9,260 jobs that provided residents in the region incomes valued at slightly more than $0.6 billion.

Table 3: Direct Economic Activity Associated with Manufacturing in Region D
(Year 2000, monetary figures in $millions)

Sector	Sales Activity			No. of Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Aircraft	$816.24	$21.00	$795.24	2,993	$220.13	$8.74
Poultry processing	$736.17	$77.37	$658.81	5,444	$178.41	$5.76
Cyclic crude & industrial organic chemicals	$615.38	$242.49	$372.89	820	$145.81	$10.52
Blast furnaces and steel mills	$520.63	$45.43	$475.20	1,566	$106.36	$5.03
Sanitary paper products	$519.59	$3.49	$516.09	911	$245.61	$6.53
All other manufacturing sectors	$7,672.60	$1,094.67	$6,577.93	40,015	$2,331.25	$73.43
Total	$10,880.62	$1,484.45	$9,396.17	51,749	$3,227.57	$110.02

Source: Generated using IMPLAN models and data from MIG, Inc.

Direct impacts to manufacturing were estimated by distributing water shortages among industrial sectors at the county level. Care was taken to include only sectors recorded in the TWDB Water Uses database. Some sectors in IMPLAN databases are not part of the TWDB database given that they use relatively small amounts of water - primarily for on-site sanitation and potable uses. To maintain consistency between IMPLAN and TWDB databases, Standard Industrial Classification (SIC) codes in TWDB databases were matched to IMPLAN sector codes for each affected county. Non-matches were excluded when calculating direct impacts.

The distribution of water shortages among TWDB manufacturing sectors is weighted according to year 2000 water use. Accordingly, industries with the greatest use are affected the most. As a general observation, these sectors include petroleum and chemical refineries, plastic producers, paper mills, food processors and cement manufacturers. Other manufacturing sectors use considerably less water for productive processes and are less likely to suffer substantial negative effects due to water shortages. In other words, they would likely be able to haul in enough water by truck to keep their operations running.

The Region D 2006 Water Plan indicates that under drought of record conditions, shortages to manufacturing could occur in Cass County in the Sulphur River Basin. Table 4 summarizes estimated economics impacts associated with unmet needs to manufacturers (i.e., paper milling activity) in Cass County.

Table 4: Annual Economic Associated with Unmet Water Needs for Manufacturing
(years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$13.89	$5.18	85	$0.18
2020	$19.44	$7.25	120	$0.26
2030	$47.58	$17.74	290	$0.63
2040	$55.93	$20.85	340	$0.74
2050	$62.70	$23.37	380	$0.82
2060	$74.78	$27.88	450	$0.98

* Estimates are based on *projected* economic activity in the region. Source: Generated by the Texas Water Development Board, Office of Water Planning.

2.3.2 Mining

No mining shortages were reported in Region D.

2.3.3 Municipal Uses

Table 5 summarizes economic activity for municipal uses. In 2000, businesses and institutions that make up the municipal category produced $19.2 billion worth of goods and services. In return, they received $11.0 billion in wages, salaries and profits. Municipal uses generate the bulk of business taxes in the region - nearly $1.0 billion (74 percent of all business taxes in the region). Top commercial sectors in terms of income and output include wholesale trade, real estate, banking and real estate and new home construction.

Table 5: Direct Economic Activity Associated with Municipal Uses in the Northeast Texas Regional Water Planning Area (Year 2000, monetary figures in $millions)						
Sector	Sales Activity			Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Banking	$1,176.05	$312.41	$863.64	6,302	$759.79	$19.01
Wholesale trade	$1,148.11	$642.98	$505.13	12,512	$629.00	$163.62
New residential structures	$876.83	$0.00	$876.83	5,751	$153.68	$5.19
Real estate	$827.34	$392.93	$434.41	4,528	$490.63	$97.88
Freight transport & warehousing	$745.98	$515.36	$230.62	7,489	$285.41	$8.97
Eating & drinking establishments	$601.18	$45.81	$555.38	17,642	$269.94	$37.67
All other municipal sectors	$13,817.97	$4,210.63	$9,607.34	226,585	$8,393.86	$653.31
Total	$19,193.46	$6,120.12	$13,073.35	280,809	$10,982.31	$985.65
Source: Generated using data from MIG, Inc., and models developed by the TWDB using IMPLAN software.						

Estimating direct economics impacts for the municipal category is complicated for a number of reasons. For one, municipal uses comprise a range of different consumers including commercial businesses, institutions (e.g., schools and government) and households. However, reported shortages do not specify how needs are distributed among different consumers. In other words, how much of a municipal need is commercial and how much is residential? The amount of commercial water use as a percentage of total municipal demand was estimated based on “GED” coefficients (gallons per employee per day) published in secondary sources (see Attachment A). For example, if year 2000 baseline data for a given economic sector (e.g., amusement and recreation services) shows employment at 30 jobs and the GED coefficient is 200, then average daily water use by that sector is (30 x 200 = 6,000 gallons) and thus annual use is 6.7 acre-feet. Water not attributed to commercial use is considered domestic, which includes single and multi-family residential consumption, institutional uses and all use designated as “county-other.” The estimated proportion of water used for commercial purposes ranges from about 5 to 35 percent of total municipal demand at the county level. Less populated rural counties occupy the lower end of the spectrum, while larger metropolitan counties are at the higher end.

As mentioned earlier, a key study assumption is that people would eliminate outdoor water use before indoor water consumption was affected; and they would implement *voluntary* emergency indoor water conservation measures before people had to curtail business operations or seek emergency sources of water. This is logical because most water utilities have drought contingency plans. Plans usually specify curtailment or elimination of outdoor water use during periods of drought. In Texas, state law requires retail and wholesale water providers to prepare and submit plans to the Texas Commission on Environmental Quality (TCEQ). Plans must specify demand management measures for use during drought including curtailment of “non-essential water uses.”[7] Thus, when assessing municipal needs there are several important considerations: 1) how much of a need would people reduce via eliminating outdoor uses and implementing emergency indoor conservation measures; and 2) what are the economic implications of such measures?

[7] Non-essential uses include, but are not limited to, landscape irrigation and water for swimming pools or fountains. For further information see the Texas Environmental Quality Code §288.20.

Determining how much water is used for outdoor purposes is key to answering these questions. The proportion used here is based on several secondary sources. The first is a major study sponsored by the American Water Works Association, which surveyed cities in states including Colorado, Oregon, Washington, California, Florida and Arizona. On average across all cities surveyed 58 percent of residential water use was for outdoor activities. In cities with climates comparable to large metropolitan areas of Texas, the average was 40 percent.[8]Earlier findings of the U.S. Water Resources Council showed a national average of 33 percent. Similarly, the United States Environmental Protection Agency (USEPA) estimated that landscape watering accounts for 32 percent of total residential and commercial water use on annual basis.[9] A study conducted for the California Urban Water Agencies (CUWA) calculated values ranging from 25 to 35 percent.[10] Unfortunately, there does not appear to be any comprehensive research that has estimated non-agricultural outdoor water use in Texas. As an approximation, an average annual value of 30 percent based on the above references was selected to serve as a rough estimate in this study. With respect to emergency indoor conservation measures, this analysis assumes that citizens in affected communities would reduce needs by an additional 20 percent. Thus, 50 percent of total needs could be eliminated before households and businesses had to implement emergency water procurement activities.

Eliminating outdoor watering would have a range of economic implications. For one, such a restriction would likely have adverse impacts on the landscaping and horticultural industry. If people are unable to water their lawns, they will likely purchase less lawn and garden materials such as plants and fertilizers. On the other hand, during a bad drought people may decide to invest in drought tolerant landscaping, or they might install more efficient landscape plumbing and other water saving devices. But in general, the horticultural industry would probably suffer considerable losses if outdoor water uses were restricted or eliminated. For example, many communities in Colorado, which is in the midst of a prolonged drought, have severely restricted lawn irrigation. In response, the turf industry in Colorado has laid off at least 50 percent of its 2,000 employees.[11] To capture impacts to the horticultural industry, regional sales net of exports for the greenhouse and nursery sectors and the landscaping services sector were reduced by proportion equal to reductions in outdoor water use. Note that these losses would not necessarily appear as losses to the regional or state economies because people would likely spend the money that they would have spent on landscaping on other goods in the economy. Thus, the net effect to state or regional accounts could be neutral.

Other considerations include the "welfare" losses to consumers who had to forgo outdoor and indoor water uses to reduce needs. In other words, the water that people would have to give up has an economic value. Estimating the economic value of this forgone water for each planning area would be a very time consuming and costly task, and thus secondary sources served as a proxy. Previous research funded by the TWDB, explored consumer "willingness to pay" for avoiding restrictions on water use.[12] Surveys revealed that residential water consumers in Texas would be willing to pay – on average across all income levels - $36 to avoid a 30 percent reduction in water availability lasting for at least 28 days. Assuming the average person in Texas uses 140

[8] See, Mayer, P.W., DeOreo, W.B., Opitz, E.M., Kiefer, J.C., Davis, W., Dziegielewski, D., Nelson, J.O. "*Residential End Uses of Water*." Research sponsored by the American Water Works Association and completed by Aquacraft, Inc. and Planning and Management Consultants, Ltd. (PMCL@CDM).

[9] U.S. Environmental Protection Agency. *"Cleaner Water through Conservation*." USEPA Report no. 841-B-95-002. April, 1995.

[10] Planning and Management Consultants, Ltd. "*Evaluating Urban Water Conservation Programs: A Procedures Manual*." Prepared for the California Urban Water Agencies. February 1992.

[11] Based on assessments of the Rocky Mountain Sod Growers. See, "*Drought Drying Up Business for Landscapers*." Associated Press. September, 17 2002.

[12] See, Griffin, R.C., and Mjelde, W.M. "*Valuing and Managing Water Supply Reliability*. Final Research Report for the Texas Water Development Board: Contract no. 95-483-140." December 1997.

gallons per day and the typical household in the state has 2.7 persons (based on U.S. Census data), total monthly water use is 13,205 gallons per household. Therefore, the value of restoring 30 percent of average monthly water use during shortages to residential consumers is roughly one cent per gallon or $2,930 per acre-foot. This figure serves as a proxy to measure consumer welfare losses that would result from restricted outdoor uses and emergency indoor restrictions.

The above data help address the impacts of incurring water needs that are 50 percent or less of projected use. Any amount greater than 50 percent would result in municipal water consumers having to seek alternative sources. Costs to residential and non-water intensive commercial operations (i.e., those that use water only for sanitary purposes) are based on the most likely alternative source of water in the absence of water management strategies. In this case, the most likely alternative is assumed to be "hauled-in" water from other communities at annual cost of $6,530 per acre-foot for small rural communities and approximately and $10,995 per acre-foot for metropolitan areas.[13]

This is not an unreasonable assumption. It happened during the 1950s drought and more recently in Texas and elsewhere. For example, in 2000 at the heels of three consecutive drought years Electra - a small town in North Texas - was down to its last 45 days worth of reservoir water when rain replenished the lake, and the city was able to refurbish old wells to provide supplemental groundwater. At the time, residents were forced to limit water use to 1,000 gallons per person per month - less than half of what most people use - and many were having water hauled delivered to their homes by private contractors.[14] In 2003 citizens of Ballinger, Texas, were also faced with a dwindling water supply due to prolonged drought. After three years of drought, Lake Ballinger, which supplies water to more than 4,300 residents in Ballinger and to 600 residents in nearby Rowena, was almost dry. Each day, people lined up to get water from a well in nearby City Park. Trucks hauling trailers outfitted with large plastic and metal tanks hauled water to and from City Park to Ballinger.[15] In Australia, four cities have run out of water as a result of drought, and residents have been trucking in water since November 2002. One town has five trucks carting about one acre-foot eight times daily from a source 20 miles away. They had to build new roads and infrastructure to accommodate the trucks. Residents are currently restricted to indoor water use only.[16]

Direct impacts to commercial sectors were estimated in a fashion similar to other business sectors. Output was reduced among "water intensive" commercial sectors according to the severity of projected shortages. Water intensive is defined as non-medical related sectors that are heavily dependent upon water to provide their services. These include:

- car-washes,
- laundry and cleaning facilities,
- sports and recreation clubs and facilities including race tracks,
- amusement and recreation services,
- hotels and lodging places, and
- eating and drinking establishments.

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[13] For rural communities, figure assumes an average truck hauling distance of 50 miles at a cost of 8.4 cents per ton-mile (an acre foot of water weighs about 1,350 tons) with no rail shipment. For communities in metropolitan areas, figure assumes a 50 mile truck haul, and a rail haul of 300 miles at a cost of 1.2 cents per ton-mile. Cents per ton-mile are based on figures in: Forkenbrock, D.J., "*Comparison of External Costs of Rail and Truck Freight Transportation*." Transportation Research. Vol. 35 (2001).

[14] Zewe, C. "*Tap Threatens to Run Dry in Texas Town*." July 11, 2000. CNN Cable News Network.

[15] Associated Press, "*Ballinger Scrambles to Finish Pipeline before Lake Dries Up*." May 19, 2003.

[16] Healey, N. (2003) *Water on Wheels*, Water: Journal of the Australian Water Association, June 2003.

For non-water intensive sectors, it is assumed that businesses would haul water by truck and/or rail.

An example will illustrate the breakdown of municipal water needs and the overall approach to estimating impacts of municipal needs. Assume City B has an unmet need of 50 acre feet in 2020 and projected demands of 200 acre-feet. In this case, residents of City B could eliminate needs via restricting all outdoor water use. City A, on the other hand, has an unmet need of 150 acre-feet in 2020 with a projected demand of 200 acre-feet. Thus, total shortages are 75 percent of total demand. Emergency outdoor and indoor conservation measures would eliminate 50 acre-feet of projected needs; however, 50 acre-feet would still remain. This remaining portion would result in costs to residential and commercial water users. Water intensive businesses such as car washes, restaurants, motels, race tracks would have to curtail operations (i.e., output would decline), and residents and non-water intensive businesses would have to have water hauled-in assuming it was available.

The last element of municipal water shortages considered focused on lost water utility revenues. Estimating these was straightforward. Analyst used annual data from the "*Water and Wastewater Rate Survey*" published annually by the Texas Municipal League to calculate an average value per acre-foot for water and sewer. For water revenues, averages rates multiplied by total water needs served as a proxy. For lost wastewater, total unmet needs were adjusted for return flow factor of 0.60 and multiplied by average sewer rates for the region. Needs reported as "county-other" were excluded under the presumption that these consist primarily of self-supplied water uses. In addition, 15 percent of water demand and needs are considered non-billed or "unaccountable" water that comprises things such leakages and water for municipal government functions (e.g., fire departments). Lost tax receipts are based on current rates for the "miscellaneous gross receipts tax, "which the state collects from utilities located in most incorporated cities or towns in Texas.

The Region D 2006 Water Plan indicates that under drought of record conditions, shortages to municipal water uses would occur in Bowie, Cass, Gregg, Harrison, Hopkins, Hunt, Morris, Rains, Smith, Van Zandt and Wood counties. Tables 6 through 9 summarize estimated impacts to domestic uses, commercial businesses, water utilities and the horticultural industry. Attachment B of this report shows impacts by county, and Attachment C shows impacts by major river basin.

Table 6: Annual Economic Impacts of Unmet Water Needs for Water Intensive Commercial Businesses
(years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$0.00	$0.00	0	$0.00
2020	$0.00	$0.00	0	$0.00
2030	$0.00	$0.00	0	$0.00
2040	$0.00	$0.00	0	$0.00
2050	$0.00	$0.00	0	$0.00
2060	$0.00	$0.00	0	$0.00

* Estimates are based on *projected* economic activity in the region. Source: Source: Texas Water Development Board, Office of Water Resources Planning.

Table 7: Annual Economic Impacts of Unmet Water Needs for the Horticultural Industry (years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)				
Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$0.21	$0.13	5	$0.005
2020	$0.29	$0.17	7	$0.008
2030	$0.34	$0.20	8	$0.009
2040	$0.43	$0.26	11	$0.011
2050	$0.54	$0.32	13	$0.014
2060	$0.61	$0.36	15	$0.016
Source: Generated by the Texas Water Development Board, Office of Water Resources Planning.				

Table 8: Annual Impacts to Domestic Water Users (years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)	
Year	$millions
2010	$4.45
2020	$6.08
2030	$7.66
2040	$9.44
2050	$12.53
2060	$19.75
Source: Generated by Texas Water Development Board, Office of Water Resources Planning.	

Table 9: Annual Losses of Water Utility Revenues and Taxes due to Unmet Water Needs (years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)		
Year	Revenues ($millions)	Utility Taxes ($millions)
2010	$1.41	$0.02
2020	$2.08	$0.04
2030	$2.56	$0.05
2040	$2.88	$0.05
2050	$3.35	$0.06
2060	$4.19	$0.07
Source: Generated by the Texas Water Development Board, Office of Water Resources Planning.		

2.3.4 Steam-Electric Uses

The steam electric sector represents economy activity associated with retail and wholesale transactions of electricity. As shown in Table 10, in 2000 the electric services sector generated annual sales of approximately $596 million resulting in nearly $426 million in income for residents in the region. The electric services sector directly supports an estimated 1,040 full and part-time jobs.

Table 10: Direct Economic Activity Associated with Steam Electric Production in Region D
(Year 2000, monetary figures in $millions)

Sector	Sales Activity			No. of Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Electric Services	$596.30	$154.60	$441.70	1,040	$426.40	$76.40

Source: Generated using data from MIG, Inc., and models developed by the TWDB using IMPLAN software.

Without adequate cooling water, power plants cannot safely operate. As water availability falls below projected demands, water levels in lakes and rivers that provide cooling water would also decline, particularly during drought when surface flows are reduced. Low water levels could affect raw water intakes and water discharge outlets (i.e., outfalls) at power facilities in several ways. For one, power plants are regulated by thermal emission guidelines that specify the maximum amount of heat that can go back into a river or lake via discharged cooling water. Low lake or river levels could result in permit compliance issues due to reduced dilution and dispersion of heat and subsequent impacts on aquatic biota near outfalls.[17] But the primary concern would be a loss of head (i.e., pressure) over intake structures that would decrease flows through intake tunnels. This could affect safety related pumps, increase operating costs and/or result in sustained shut-downs. Assuming plants did shutdown, they would not be able to generate electricity, which implies that output (i.e., sales of electricity) would decline.

Among all water use categories, steam-electric is unique and cautions are necessary when applying methods used in this study. Measured changes to an economy using input-output models stem directly from changes in sales revenue. In the case of water shortages, one assumes that businesses will suffer lost output if process water is in short supply. For power generation facilities this is true as well. However, the electric services sector in IMPLAN represents a corporate entity that may own and operate several power plants in a given region. If one plant became inoperable due to water shortages, plants in other areas or generation facilities that do not rely heavily water (e.g., gas powered turbines or "peaking plants") might be able to compensate for lost generating capacity. Utilities could also offset lost production via purchases on the spot market.[18] Thus, to presume that electricity would stop flowing may be unrealistic, but to maintain consistency, the model assumes that water shortages would result in lost sales of

[17] Section 316 (b) of the Clean Water Act requires that thermal wastewater discharges do not harm fish and other wildlife.

[18] Today, most utilities participate in large interstate "power pools" and can buy or sell electricity "on the grid" from other utilities or power marketers. Thus, assuming power was available to buy, and assuming that no contractual or physical limitations were in place (e.g., transmission constraints); utilities could offset lost power that resulted from waters shortages with purchases via the power grid.

electricity.[19] Another related consideration is that IMPLAN output data report all sales transactions for particular utility in a given county - including sales generated from stations outside a county. As a countermeasure, analysts estimated sales for affected counties using production and price data from the U.S. Energy Information Administration.

The Region D 2006 Water Plan indicates that under drought of record conditions, shortages to steam-electric water uses would occur in -and -counties. Table 11 summarizes estimated impacts. Attachment B of this report shows impacts by county, and Attachment C shows impacts by major river basin.

Table 11: Annual Economic Impacts of Unmet Water Needs for Steam-electric Water Uses
(years 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Total Sales	Regional Income ($millions)	Jobs	Business Taxes
2010	$148.45	$124.89	970	$22.36
2020	$156.88	$131.97	1,030	$23.63
2030	$177.63	$149.44	1,165	$26.76
2040	$211.63	$178.04	1,385	$31.88
2050	$274.36	$230.80	1,795	$41.33
2060	$324.88	$273.31	2,130	$48.95

Source: Generated by the Texas Water Development Board, Office of Water Planning.

3. Regional Social Impacts

As discussed previously in Section 1.2, estimated social impacts focus changes including population loss and subsequent related in school enrollment. As shown in Table 12, water shortages in 2010 could result in a population loss of 1,850 people with a corresponding reduction is school enrollment of 480. Models indicate that shortages in 2060 could cause population in the region to fall by 4,520 people and school enrollment by 1,170 students.

[19] Losses offset through grid purchases or from peaking plants would likely result in higher production costs, which utilities would ultimately pass on to consumers in the form of higher utility bills. Determining the impacts of higher costs is not considered in this study.

Table 12: Estimated Regional Social Impacts of Unmet Water Needs (years, 2010, 2020, 2030, 2040, 2050 and 2060)		
Year	Population Losses	Declines in School Enrollment
2010	1,850	480
2020	2,000	520
2030	2,540	650
2040	3,020	780
2050	3,810	980
2060	4,520	1,170
Source: Generated by the Texas Water Development Board, Office of Water Planning.		

Attachment A: Baseline Regional Economic Data

Tables A-1 through A-6 contain data from several sources that form a basis of analyses in this report. Economic statistics were extracted and processed via databases purchased from MIG, Inc. using IMPLAN Pro™ software. Values for gallons per employee (i.e. GED coefficients) for the municipal water use category are based on several secondary sources.[20] County-level data sets along with multipliers are not included given their large sizes (i.e., 528 sectors per county each with 12 different multiplier coefficients). Fields in Tables A-1 through A-6 contain the following variables:

- *GED -* average gallons of water use per employee per day (municipal use only);
- *total sales -* total industry production measured in millions of dollars (equal to shipments plus net additions to inventories);
- *intermediate sales -* sales to other industries in the region measured in millions of dollars;
- *final sales -* all sales to end-users including sales to households in the region and exports out of the region;
- *jobs -* number of full and part-time jobs (annual average) required by a given industry;
- *regional income -* total payroll costs (wages and salaries plus benefits), proprietor income, corporate income, rental income and interest payments;
- *business taxes –* sales taxes, excise taxes, fees, licenses and other taxes paid during normal business operations (includes all payments to federal, state and local government except income taxes).

[20] Sources for GED coefficients include: Gleick, P.H., Haasz, D., Henges-Jeck, C., Srinivasan, V., Wolff, G. Cushing, K.K., and Mann, A. "*Waste Not, Want Not. The Potential for Urban Water Conservation in California*." Pacific Institute. November 2003. U.S. Bureau of the Census. 1982 Census of Manufacturers: Water Use in Manufacturing. USGPO, Washington D.C. See also: "*U.S. Army Engineer Institute for Water Resources, IWR Report 88-R-6.*," Fort Belvoir, VA. See also, Joseph, E. S., 1982, "*Municipal and Industrial Water Demands of the Western United States*." Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, v. 108, no. WR2, p. 204-216. See also, Baumann, D. D., Boland, J. J., and Sims, J. H., 1981, "*Evaluation of Water Conservation for Municipal and Industrial Water Supply*." U.S. Army Corps of Engineers, Institute for Water Resources, Contract no. 82-C1.

Table A-1: Economic Data for Crop Production in Region D (Year 2000)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Cotton	$4.54	$0.10	$4.44	70	$3.90	$0.34
Feed Grains	$11.56	$2.73	$8.83	329	$9.35	$1.05
Food Grains	$1.87	$0.11	$1.76	96	$1.32	$0.13
Fruits	$1.88	$0.04	$1.84	54	$0.71	$0.04
Grass Seeds	$2.78	$0.23	$2.55	321	$1.73	$0.02
Hay and Pasture	$94.96	$22.42	$72.53	8,685	$41.36	$4.07
Oil Bearing Crops	$16.18	$1.03	$15.14	593	$12.63	$1.22
Tree Nuts	$1.76	$0.14	$1.62	49	$1.05	$0.03
Vegetables	$22.99	$5.54	$17.45	439	$14.42	$0.54
Total	$158.50	$32.34	$126.16	10,635	$86.48	$7.43

Data for crop sectors includes dry-land and irrigated acreage. na = "not applicable"

Table A-2: Economic Data for Livestock Sectors, Region D (Year 2000)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Cattle Feedlots	$10.74	$8.69	$2.04	72	$9.30	$0.74
Dairy Farm Products	$175.71	$68.04	$107.67	1989	$73.81	$0.54
Hogs, Pigs and Swine	$1.95	$1.92	$0.03	55	$0.60	$0.07
Misc. Livestock	$10.25	$1.22	$9.03	866	$3.99	$0.10
Poultry and Eggs	$292.78	$282.81	$9.97	1,946	$43.45	$0.76
Ranch Fed Cattle	$114.68	$18.96	$95.72	3836	$41.97	$3.01
Range Fed Cattle	$35.08	$10.18	$24.90	1,259	$14.83	$0.95
Sheep, Lambs & Goats	$0.14	$0.13	$0.01	22	$0.05	$0.00
Total	$641.32	$391.96	$249.37	10,046	$188.01	$6.18

na = "not applicable"

Table A-3: Economic Data for Municipal Sectors, Region D (Year 2000)

Sector	GED	Total Sales	Intermediate Sales	Final Sales	Labor Force	Regional Income	Business Taxes
Accounting, Auditing and Bookkeeping	120	$220.71	$140.98	$79.72	3686	$173.93	$1.98
Advertising	117	$17.87	$17.24	$0.63	196	$8.23	$0.15
Agricultural, Forestry, Fishery Services	-	$16.92	$16.42	$0.50	844	$9.53	$0.42
Air Transportation	171	$139.16	$38.02	$101.14	1548	$68.13	$9.74
Amusement and Recreation Services	427	$25.49	$0.19	$25.30	1062	$14.31	$1.39
Apparel & Accessory Stores	68	$66.74	$4.20	$62.54	1948	$36.89	$10.65
Arrangement Of Passenger Transportation	130	$55.50	$10.83	$44.67	355	$38.32	$1.66
Automobile Parking and Car Wash	681	$15.80	$1.66	$14.14	443	$10.67	$0.73
Automobile Rental and Leasing	147	$20.83	$14.50	$6.33	228	$12.16	$1.65
Automobile Repair and Services	55	$282.42	$61.29	$221.13	3510	$142.97	$12.96
Automotive Dealers & Service Stations	49	$494.78	$79.89	$414.89	7125	$295.07	$76.53
Banking	59	$1,176.05	$312.41	$863.64	6302	$759.79	$19.01
Beauty and Barber Shops	216	$34.07	$2.81	$31.26	1361	$20.55	$0.40
Bowling Alleys and Pool Halls	86	$2.72	$0.01	$2.71	193	$1.34	$0.22
Building Materials & Gardening	35	$150.62	$14.03	$136.58	3134	$107.46	$24.78
Business Associations	160	$42.73	$13.63	$29.10	1042	$29.80	$0.03
Child Day Care Services	120	$62.00	$0.00	$62.00	1666	$17.37	$0.50
Colleges, Universities, Schools	75	$65.28	$0.99	$64.29	2538	$41.55	$0.00
Commercial Sports Except Racing	391	$0.86	$0.36	$0.51	16	$0.58	$0.05
Commodity Credit Corporation	-	$0.00	$0.00	$0.00	0	$0.00	$0.00
Communications, Except Radio and TV	47	$447.32	$205.65	$241.67	1815	$223.95	$23.84
Computer and Data Processing Services	40	$65.37	$35.05	$30.32	1034	$52.89	$0.99
Credit Agencies	156	$159.68	$110.52	$49.17	4479	$83.74	$5.44
Detective and Protective Services	84	$16.92	$11.84	$5.08	508	$12.86	$0.23
Doctors and Dentists	203	$730.90	$0.00	$730.90	7410	$488.57	$9.38

Table A-3: Economic Data for Municipal Sectors, Region D (Year 2000)

Domestic Services	-	$32.60	$32.60	$0.00	4012	$32.33	$0.00
Eating & Drinking	157	$601.18	$45.81	$555.38	17642	$269.94	$37.67
Electrical Repair Service	37	$34.14	$14.53	$19.61	467	$13.07	$1.13
Elementary and Secondary Schools	169	$15.11	$0.00	$15.11	674	$8.91	$0.00
Engineering, Architectural Services	87	$120.78	$92.67	$28.11	1377	$50.35	$0.74
Equipment Rental and Leasing	29	$149.11	$58.76	$90.35	1194	$66.84	$4.64
Federal Government - Military	-	$61.67	$61.67	$0.00	1814	$61.67	$0.00
Federal Government - Non-Military	-	$294.97	$294.97	$0.00	5081	$294.97	$0.00
Food Stores	98	$307.86	$9.69	$298.17	8867	$230.80	$49.20
Funeral Service and Crematories	111	$65.35	$0.00	$65.35	1562	$43.28	$1.86
Furniture & Home Furnishings Stores	42	$89.57	$9.16	$80.41	2369	$58.13	$14.05
Gas Production and Distribution	51	$191.38	$116.12	$75.26	197	$45.16	$12.49
General Merchandise Stores	47	$303.90	$8.80	$295.10	9898	$191.11	$48.49
Greenhouse and Nursery Products	-	$66.12	$15.48	$50.64	1815	$50.81	$0.69
Hospitals	76	$632.15	$0.23	$631.92	9586	$392.89	$2.20
Hotels and Lodging Places	230	$91.93	$41.32	$50.60	2216	$47.08	$6.06
Insurance Agents and Brokers	89	$132.43	$25.88	$106.55	2894	$102.77	$1.41
Insurance Carriers	136	$103.20	$10.16	$93.04	1024	$51.10	$5.23
Inventory Valuation Adjustment	-	-$10.82	-$10.82	$0.00	0	-$10.62	$0.00
Job Trainings & Related Services	141	$6.53	$1.79	$4.74	184	$3.12	$0.01
Labor and Civic Organizations	122	$57.31	$0.32	$56.99	4072	$42.03	$0.01
Landscape and Horticultural Services	-	$60.58	$40.15	$20.44	2047	$35.74	$1.54
Laundry, Cleaning and Shoe Repair	517	$48.05	$12.30	$35.75	2344	$35.36	$1.23
Legal Services	76	$148.93	$62.95	$85.98	1779	$114.64	$1.34
Local Government Passenger Transit	-	$0.11	$0.02	$0.10	4	-$0.43	$0.00
Local, Interurban Passenger Transit	68	$20.19	$3.20	$16.99	431	$12.35	$0.44
Maintenance a Oil and Gas Wells	25	$234.80	$132.57	$102.23	1877	$135.50	$9.24
Maintenance and Repair Other Facilities	25	$371.17	$153.15	$218.02	6736	$250.21	$1.67
Maintenance and Repair, Residential	25	$277.04	$69.08	$207.96	2134	$73.48	$1.00
Management and Consulting Services	87	$85.29	$53.59	$31.71	925	$46.03	$0.61
Membership Sports and Recreation Clubs	427	$32.69	$1.19	$31.49	1176	$16.64	$1.18
Miscellaneous Personal Services	129	$42.35	$3.26	$39.10	636	$11.21	$0.85
Miscellaneous Repair Shops	124	$73.88	$45.20	$28.68	1160	$32.95	$2.06
Miscellaneous Retail	132	$383.93	$29.63	$354.29	9792	$240.81	$58.66
Motion Pictures	113	$56.84	$25.35	$31.49	754	$17.47	$0.61
Motor Freight Transport and Warehousing	85	$745.98	$515.36	$230.62	7489	$285.41	$8.97
New Government Facilities	63	$469.29	$0.00	$469.29	3213	$169.60	$2.67
New Highways and Streets	45	$114.94	$0.00	$114.94	1095	$41.65	$0.68
New Industrial and Commercial Buildings	63	$454.22	$0.00	$454.22	4029	$150.68	$3.12
New Mineral Extraction Facilities	63	$293.17	$3.28	$289.89	4759	$176.91	$14.27
New Residential Structures	35	$876.83	$0.00	$876.83	5751	$153.68	$5.19
New Utility Structures	63	$196.17	$0.00	$196.17	1970	$76.33	$0.99
Nursing and Protective Care	197	$256.58	$0.00	$256.58	8178	$185.86	$6.30
Other Business Services	84	$232.44	$201.32	$31.12	2524	$88.44	$3.22
Other Educational Services	116	$15.91	$2.99	$12.92	374	$5.00	$0.37
Other Federal Government Enterprises	-	$4.47	$1.25	$3.23	35	$0.55	$0.00
Other Medical and Health Services	168	$355.61	$17.42	$338.18	9166	$164.40	$5.13
Other Nonprofit Organizations	122	$28.47	$1.58	$26.90	1152	$14.87	$0.18
Other State and Local Gov't Enterprises	-	$152.15	$49.29	$102.86	835	$48.61	$0.00
Owner-occupied Dwellings	89	$1,348.26	$0.00	$1,348.26	0	$846.46	$174.83
Personnel Supply Services	484	$84.72	$72.08	$12.64	4280	$81.58	$1.61
Photofinishing, Commercial Photography	112	$29.84	$20.24	$9.60	274	$11.74	$0.72
Pipe Lines, Except Natural Gas	49	$51.53	$6.95	$44.59	120	$35.78	$4.23
Portrait and Photographic Studios	184	$10.68	$0.82	$9.86	304	$4.75	$0.24
Racing and Track Operation	391	$2.08	$0.08	$2.00	60	$0.78	$0.36
Radio and TV Broadcasting	64	$41.14	$36.87	$4.27	275	$14.06	$0.52
Railroads and Related Services	68	$94.86	$63.54	$31.33	577	$41.83	$2.22
Real Estate	89	$827.34	$392.93	$434.41	4528	$490.63	$97.88
Religious Organizations	328	$23.15	$0.00	$23.15	192	$2.13	$0.00
Research, Development & Testing	123	$23.32	$4.81	$18.50	424	$11.94	$0.22
Residential Care	111	$52.43	$0.00	$52.43	1928	$32.39	$0.46
Sanitary Services and Steam Supply	51	$58.10	$43.26	$14.84	219	$24.28	$10.64
Security and Commodity Brokers	59	$120.46	$82.63	$37.83	788	$32.35	$3.22
Services To Buildings	67	$50.07	$38.24	$11.84	1206	$23.90	$0.95
Social Services, N.E.C.	42	$50.54	$4.25	$46.28	1085	$15.66	$0.05
State & Local Government - Education	-	$797.63	$797.63	$0.00	25744	$797.63	$0.00

Table A-3: Economic Data for Municipal Sectors, Region D (Year 2000)

State & Local Government - Non-Education	-	$469.06	$469.06	$0.00	12191	$469.06	$0.00
State and Local Electric Utilities	-	$14.57	$3.76	$10.81	26	$6.25	$0.00
Theatrical Producers, Bands Etc.	36	$2.76	$1.31	$1.45	48	$0.68	$0.06
Transportation Services	40	$21.17	$15.09	$6.08	215	$15.81	$0.18
U.S. Postal Service	-	$117.57	$60.03	$57.54	1622	$84.68	$0.00
Watch, Jewelry and Furniture Repair	50	$7.60	$0.07	$7.53	134	$2.74	$0.38
Water Supply and Sewerage Systems	51	$43.76	$13.41	$30.35	236	$23.84	$2.97
Water Transportation	353	$13.37	$4.27	$9.10	69	$2.01	$0.18
Wholesale Trade	43	$1,148.11	$642.98	$505.13	12512	$629.00	$163.62
Total	-	$19,193.46	$6,120.12	$13,073.35	3686	$173.93	$985.65

Table A-4: Economic Data for Manufacturing Sectors, Region D (Year 2000)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Abrasive Products	$0.47	$0.02	$0.45	3	$0.08	$0.00
Adhesives and Sealants	$0.72	$0.58	$0.15	3	$0.26	$0.01
Aircraft	$816.24	$21.00	$795.24	2993	$220.13	$8.74
Aircraft and Missile Equipment,	$6.70	$0.11	$6.59	50	$3.07	$0.06
Aluminum Foundries	$25.01	$1.31	$23.70	232	$8.88	$0.22
Aluminum Rolling and Drawing	$137.72	$5.36	$132.36	430	$30.97	$1.46
Ammunition, Except For Small Arms, N.E.C.	$44.75	$0.74	$44.01	888	$38.35	$0.44
Animal and Marine Fats and Oils	$90.49	$36.76	$53.73	316	$30.27	$0.69
Apparel Made From Purchased Materials	$59.85	$1.20	$58.65	592	$12.52	$0.21
Architectural Metal Work	$1.56	$0.04	$1.52	19	$0.80	$0.01
Asphalt Felts and Coatings	$44.32	$11.77	$32.55	139	$29.74	$0.40
Automotive and Apparel Trimmings	$5.40	$2.13	$3.27	40	$0.86	$0.03
Automotive Stampings	$7.06	$2.18	$4.88	44	$1.39	$0.05
Bags, Paper	$6.76	$0.06	$6.71	37	$2.29	$0.07
Bags, Plastic	$75.38	$0.63	$74.76	385	$22.36	$0.73
Blast Furnaces and Steel Mills	$520.63	$45.43	$475.20	1566	$106.36	$5.03
Blowers and Fans	$12.46	$0.16	$12.30	109	$5.61	$0.12
Boat Building and Repairing	$29.41	$0.06	$29.35	256	$10.52	$0.22
Book Publishing	$15.42	$0.70	$14.72	76	$3.68	$0.13
Brass, Bronze, and Copper Foundries	$0.62	$0.02	$0.60	18	$0.36	$0.01
Bread, Cake, and Related Products	$110.68	$16.22	$94.47	633	$40.48	$0.69
Broadwoven Fabric Mills and Finishing	$0.48	$0.30	$0.18	5	$0.11	$0.00
Brooms and Brushes	$11.19	$0.78	$10.41	126	$4.94	$0.14
Burial Caskets and Vaults	$2.96	$0.90	$2.07	34	$2.31	$0.03
Canned Fruits and Vegetables	$44.16	$0.17	$43.98	175	$16.91	$0.38
Canned Specialties	$453.30	$1.79	$451.51	970	$146.81	$3.40
Canvas Products	$0.64	$0.40	$0.24	11	$0.22	$0.00
Carburetors, Pistons, Rings, Valves	$13.38	$1.08	$12.29	115	$4.07	$0.09
Ceramic Wall and Floor Tile	$3.62	$0.04	$3.58	50	$1.31	$0.04
Chemical Preparations, N.E.C	$487.91	$52.14	$435.77	1302	$172.66	$5.00
Clay Refractories	$2.10	$0.02	$2.09	22	$0.78	$0.02
Commercial Fishing	$2.74	$0.34	$2.41	117	$2.49	$0.08
Commercial Printing	$75.46	$39.74	$35.73	705	$23.16	$0.69
Communications Equipment N.E.C.	$21.91	$4.82	$17.09	182	$14.35	$0.20
Complete Guided Missiles	$16.83	$0.81	$16.02	64	$9.16	$0.22
Computer Storage Devices	$0.76	$0.24	$0.52	3	$0.08	$0.00
Concrete Products, N.E.C	$19.38	$0.09	$19.29	168	$6.43	$0.24
Condensed and Evaporated Milk	$8.92	$2.57	$6.35	19	$1.56	$0.04
Confectionery Products	$12.30	$0.05	$12.25	48	$3.35	$0.08
Construction Machinery and Equipment	$283.11	$7.91	$275.19	1078	$60.61	$2.40
Cookies and Crackers	$17.08	$0.48	$16.61	105	$7.24	$0.13
Cottonseed Oil Mills	$1.53	$1.42	$0.11	4	$0.21	$0.01
Curtains and Draperies	$0.16	$0.03	$0.14	2	$0.04	$0.00
Cutlery	$0.09	$0.01	$0.08	3	$0.07	$0.00
Cyclic Crudes, Interm. & Indus. Organic Chem.	$615.38	$242.49	$372.89	820	$145.81	$10.52
Dehydrated Food Products	$1.59	$0.08	$1.50	10	$0.35	$0.01
Die-cut Paper and Board	$1.12	$0.02	$1.10	9	$0.32	$0.01
Dog, Cat, and Other Pet Food	$0.72	$0.00	$0.72	2	$0.10	$0.00
Drugs	$20.60	$6.79	$13.81	93	$11.06	$0.23
Electric Lamps	$13.70	$0.13	$13.57	99	$8.60	$0.14
Electrical Equipment, N.E.C.	$0.38	$0.08	$0.31	2	$0.08	$0.00
Electrical Industrial Apparatus, N.E.C.	$15.20	$1.03	$14.17	58	$2.39	$0.10
Electronic Components, N.E.C.	$23.59	$16.79	$6.81	94	$4.69	$0.17
Engine Electrical Equipment	$66.23	$18.04	$48.19	488	$17.45	$0.43
Fabricated Metal Products, N.E.C.	$8.55	$1.60	$6.95	67	$2.47	$0.06

Table A-4: Economic Data for Manufacturing Sectors, Region D (Year 2000)

Fabricated Plate Work (Boiler Shops)	$54.56	$1.05	$53.52	539	$30.89	$0.53
Fabricated Rubber Products, N.E.C.	$0.50	$0.00	$0.50	4	$0.12	$0.00
Fabricated Structural Metal	$58.54	$1.42	$57.11	333	$23.83	$0.61
Fabricated Textile Products, N.E.C.	$27.71	$4.77	$22.94	200	$7.41	$0.16
Farm Machinery and Equipment	$114.09	$18.28	$95.81	630	$33.37	$0.87
Fertilizers, Mixing Only	$15.11	$2.30	$12.82	47	$2.55	$0.15
Fine Earthenware Food Utensils	$0.40	$0.00	$0.39	8	$0.17	$0.00
Fluid Milk	$221.11	$11.28	$209.82	573	$43.99	$1.97
Fluid Power Cylinders & Actuators	$1.86	$0.04	$1.82	10	$0.37	$0.01
Fluid Power Pumps & Motors	$1.04	$0.02	$1.02	11	$0.41	$0.01
Food Preparations, N.E.C	$11.48	$0.05	$11.43	66	$3.04	$0.06
Forest Products	$29.75	$0.99	$28.76	732	$12.41	$0.54
Forestry Products	$20.34	$0.03	$20.31	234	$15.44	$3.13
Frozen Specialties	$0.47	$0.00	$0.47	3	$0.14	$0.00
Gaskets, Packing and Sealing Devices	$1.71	$0.01	$1.70	12	$0.76	$0.01
General Industrial Machinery, N.E.C	$3.64	$0.11	$3.53	17	$1.35	$0.03
Glass and Glass Products, Exc Containers	$0.62	$0.51	$0.11	3	$0.35	$0.01
Hand and Edge Tools, N.E.C.	$0.48	$0.21	$0.27	5	$0.28	$0.01
Hardware, N.E.C.	$27.19	$4.34	$22.84	132	$12.96	$0.30
Hardwood Dimension and Flooring Mills	$5.96	$5.54	$0.42	74	$2.78	$0.06
Housefurnishings, N.E.C	$0.53	$0.08	$0.45	4	$0.13	$0.00
Household Furniture, N.E.C	$0.42	$0.23	$0.18	6	$0.14	$0.00
Ice Cream and Frozen Desserts	$2.43	$0.72	$1.72	11	$0.59	$0.02
Industrial and Fluid Valves	$87.29	$10.16	$77.13	354	$25.30	$0.75
Industrial Furnaces and Ovens	$5.01	$0.13	$4.87	37	$1.85	$0.04
Industrial Gases	$3.90	$1.54	$2.36	26	$3.00	$0.09
Industrial Machines N.E.C.	$111.22	$1.95	$109.28	1088	$46.60	$0.92
Industrial Patterns	$3.29	$0.08	$3.22	44	$1.97	$0.02
Industrial Trucks and Tractors	$30.46	$2.40	$28.06	182	$6.33	$0.21
Inorganic Chemicals Nec.	$9.56	$3.77	$5.79	42	$3.93	$0.26
Instruments To Measure Electricity	$0.53	$0.06	$0.47	3	$0.11	$0.00
Iron and Steel Forgings	$0.35	$0.08	$0.26	3	$0.13	$0.00
Iron and Steel Foundries	$65.59	$0.55	$65.04	511	$21.82	$0.59
Jewelry, Precious Metal	$0.10	$0.00	$0.10	1	$0.03	$0.00
Knit Outerwear Mills	$0.64	$0.04	$0.60	8	$0.25	$0.01
Laboratory Apparatus & Furniture	$1.15	$0.15	$1.00	5	$0.22	$0.01
Lead Pencils and Art Goods	$1.44	$0.03	$1.41	23	$0.98	$0.02
Leather Gloves and Mittens	$11.80	$0.33	$11.47	189	$4.62	$0.00
Leather Goods, N.E.C	$2.33	$0.22	$2.10	60	$1.76	$0.01
Logging Camps and Logging Contractors	$93.51	$41.72	$51.79	586	$41.78	$1.20
Lubricating Oils and Greases	$1.92	$1.33	$0.59	5	$0.15	$0.01
Luggage	$1.24	$0.17	$1.07	11	$0.56	$0.01
Machine Tools, Metal Forming Types	$1.33	$0.31	$1.01	14	$0.42	$0.01
Malt Beverages	$21.50	$0.30	$21.20	114	$6.27	$3.53
Manifold Business Forms	$20.44	$1.86	$18.58	139	$7.33	$0.25
Manufactured Ice	$2.12	$0.03	$2.09	53	$1.20	$0.01
Manufacturing Industries, N.E.C.	$46.01	$1.30	$44.71	465	$18.90	$0.47
Meat Packing Plants	$30.53	$4.66	$25.87	82	$2.02	$0.14
Mechanical Measuring Devices	$10.19	$3.94	$6.25	74	$3.78	$0.10
Metal Cans	$201.87	$34.42	$167.45	543	$34.39	$1.72
Metal Coating and Allied Services	$13.91	$4.54	$9.37	101	$4.54	$0.11
Metal Doors, Sash, and Trim	$72.75	$2.29	$70.46	642	$31.48	$0.70
Metal Heat Treating	$0.84	$0.50	$0.34	5	$0.27	$0.01
Metal Household Furniture	$2.53	$0.24	$2.29	23	$0.50	$0.01
Metal Office Furniture	$12.93	$0.40	$12.54	75	$3.02	$0.07
Millwork	$106.43	$28.87	$77.56	1095	$37.09	$0.92
Miscellaneous Fabricated Wire Products	$13.88	$3.53	$10.35	175	$4.15	$0.08
Miscellaneous Metal Work	$1.40	$0.05	$1.35	4	$0.16	$0.01
Miscellaneous Plastics Products	$291.05	$5.77	$285.28	1670	$82.69	$1.94
Miscellaneous Publishing	$5.38	$3.58	$1.81	49	$2.44	$0.05
Mobile Homes	$1.73	$0.00	$1.73	16	$0.67	$0.02
Motor Vehicle Parts and Accessories	$279.44	$65.31	$214.13	1225	$72.69	$0.99
Motors and Generators	$1.29	$0.53	$0.76	10	$0.55	$0.02
Newspapers	$72.53	$50.81	$21.71	951	$32.01	$0.74
Nitrogenous and Phosphatic Fertilizers	$5.19	$0.84	$4.35	14	$1.33	$0.06
Nonferrous Wire Drawing and Insulating	$87.04	$2.95	$84.09	323	$16.83	$0.65
Nonmetallic Mineral Products, N.E.C.	$3.46	$0.08	$3.39	40	$1.37	$0.03
Oil Field Machinery	$41.22	$7.26	$33.96	368	$16.35	$0.34
Ophthalmic Goods	$0.48	$0.02	$0.46	5	$0.14	$0.00
Optical Instruments & Lenses	$0.16	$0.02	$0.13	3	$0.06	$0.00
Other Ordnance and Accessories	$7.64	$0.07	$7.58	20	-$0.20	$0.07
Paints and Allied Products	$339.03	$4.71	$334.32	844	$132.35	$3.89
Paperboard Containers and Boxes	$66.47	$61.45	$5.02	319	$15.74	$0.59
Paperboard Mills	$113.71	$0.42	$113.29	213	$32.42	$1.23
Paving Mixtures and Blocks	$18.74	$15.23	$3.51	52	$8.12	$0.15
Periodicals	$19.69	$10.27	$9.42	140	$5.81	$0.15
Petroleum Refining	$174.99	$92.80	$82.19	66	$16.31	$1.14
Pickles, Sauces, and Salad Dressings	$1.95	$0.04	$1.91	10	$0.27	$0.00

Table A-4: Economic Data for Manufacturing Sectors, Region D (Year 2000)

Pipe, Valves, and Pipe Fittings	$65.94	$7.68	$58.26	472	$30.80	$0.60
Plastics Materials and Resins	$17.28	$14.33	$2.95	25	$4.36	$0.17
Plating and Polishing	$2.68	$0.54	$2.15	55	$2.16	$0.03
Pleating and Stitching	$0.29	$0.07	$0.22	5	$0.19	$0.00
Polishes and Sanitation Goods	$0.43	$0.05	$0.39	2	$0.27	$0.00
Pottery Products, N.E.C	$32.81	$0.45	$32.35	464	$11.94	$0.43
Poultry Processing	$736.17	$77.37	$658.81	5444	$178.41	$5.76
Power Transmission Equipment	$11.48	$0.16	$11.32	82	$3.05	$0.08
Prefabricated Metal Buildings	$14.80	$0.29	$14.51	115	$6.46	$0.13
Prefabricated Wood Buildings	$1.88	$0.01	$1.87	17	$0.51	$0.01
Prepared Feeds, N.E.C	$203.42	$6.21	$197.21	539	$22.67	$1.46
Primary Aluminum	$1.03	$0.08	$0.96	4	$0.12	$0.01
Printing Trades Machinery	$8.51	$0.93	$7.58	54	$2.85	$0.07
Public Building Furniture	$3.05	$1.48	$1.57	18	$0.63	$0.01
Pumps and Compressors	$19.21	$0.52	$18.69	70	$5.83	$0.19
Radio and Tv Communication Equipment	$156.62	$34.44	$122.18	464	$46.52	$1.12
Railroad Equipment	$309.25	$9.28	$299.97	1193	$66.01	$2.26
Ready-mixed Concrete	$46.57	$0.27	$46.30	315	$15.18	$0.61
Reconstituted Wood Products	$0.63	$0.59	$0.04	3	$0.14	$0.00
Refrigeration and Heating Equipment	$136.04	$46.07	$89.97	701	$28.24	$0.99
Relays & Industrial Controls	$0.79	$0.67	$0.12	5	$0.27	$0.01
Rolling Mill Machinery	$0.22	$0.01	$0.21	3	$0.08	$0.00
Sanitary Paper Products	$519.59	$3.49	$516.09	911	$245.61	$6.53
Sausages and Other Prepared Meats	$26.75	$4.09	$22.66	127	$4.05	$0.15
Sawmills and Planing Mills, General	$126.18	$88.09	$38.09	747	$32.84	$1.24
Screw Machine Products and Bolts, Etc.	$2.83	$2.48	$0.35	21	$1.25	$0.03
Secondary Nonferrous Metals	$2.37	$0.16	$2.21	7	$0.21	$0.01
Sheet Metal Work	$64.38	$1.63	$62.75	494	$25.46	$0.54
Signs and Advertising Displays	$24.11	$9.94	$14.17	315	$9.43	$0.22
Silverware and Plated Ware	$0.42	$0.01	$0.40	7	$0.16	$0.01
Small Arms	$0.86	$0.00	$0.86	11	$0.63	$0.08
Special Dies and Tools and Accessories	$4.14	$3.41	$0.73	52	$2.02	$0.03
Special Industry Machinery N.E.C.	$4.62	$1.76	$2.86	13	$0.53	$0.02
Sporting and Athletic Goods, N.E.C.	$16.91	$0.08	$16.83	110	$7.69	$0.65
Structural Wood Members, N.E.C	$14.09	$9.55	$4.54	107	$5.89	$0.16
Sugar	$51.53	$0.54	$51.00	135	$5.84	$0.27
Surgical and Medical Instrument	$58.76	$12.55	$46.21	329	$16.98	$0.59
Surgical Appliances and Supplies	$9.36	$2.10	$7.26	52	$1.97	$0.08
Switchgear and Switchboard Apparatus	$22.08	$9.97	$12.11	142	$8.92	$0.17
Telephone and Telegraph Apparatus	$3.12	$1.95	$1.16	6	$1.01	$0.02
Tires and Inner Tubes	$85.30	$0.08	$85.22	467	$33.89	$3.21
Transformers	$1.56	$0.18	$1.38	15	$0.53	$0.01
Transportation Equipment, N.E.C	$219.98	$3.08	$216.90	956	$43.98	$1.47
Travel Trailers and Camper	$91.87	$1.23	$90.64	585	$20.48	$0.65
Truck Trailers	$94.63	$5.29	$89.33	652	$31.17	$0.44
Typesetting	$0.07	$0.04	$0.03	1	$0.03	$0.00
Typewriters and Office Machines N.E.C.	$0.16	$0.05	$0.11	2	$0.04	$0.00
Upholstered Household Furniture	$28.19	$1.85	$26.34	326	$9.64	$0.18
Vitreous Plumbing Fixtures	$48.03	$0.72	$47.30	481	$26.99	$0.53
Watches, Clocks, and Parts	$0.64	$0.04	$0.60	4	$0.09	$0.00
Wiring Devices	$1.41	$0.08	$1.34	13	$0.54	$0.01
Wood Containers	$1.21	$0.38	$0.84	21	$0.46	$0.01
Wood Household Furniture	$20.16	$0.40	$19.77	209	$8.22	$0.15
Wood Kitchen Cabinets	$63.36	$17.02	$46.34	803	$28.76	$0.58
Wood Pallets and Skids	$17.11	$4.57	$12.53	230	$7.06	$0.15
Wood Partitions and Fixtures	$29.93	$5.36	$24.58	286	$10.47	$0.16
Wood Preserving	$47.54	$9.96	$37.57	152	$7.91	$0.40
Wood Products, N.E.C	$27.55	$4.82	$22.73	260	$10.45	$0.27
X-Ray Apparatus	$0.84	$0.22	$0.62	3	$0.13	$0.01
Total	$10,880.62	$1,484.45	$9,396.17	51749	$3,227.57	$110.02

NEC = not elsewhere classified. "na" = not available.

Table A-5: Economic Data for Mining Sectors, Region D (Year 2000)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Chemical, Fertilizer Mineral Mininig, N.E.C.	$1.16	$0.21	$0.96	12	$0.75	$0.05
Clay, Ceramic, Refractory Minerals, N.E.C.	$0.46	$0.01	$0.45	3	$0.27	$0.02
Coal Mining	$246.63	$42.42	$204.21	783	$81.96	$31.55
Dimension Stone	$3.22	$0.05	$3.17	22	$1.96	$0.10
Iron Ores	$5.49	$0.49	$5.00	31	$0.02	$0.05
Misc. Nonmetallic Minerals, N.E.C.	$0.05	$0.00	$0.05	2	$0.03	$0.00
Natural Gas & Crude Petroleum	$1,329.97	$364.80	$965.17	2718	$607.80	$71.31
Natural Gas Liquids	$801.18	$219.76	$581.42	626	$220.42	$34.66
Potash, Soda, and Borate Minerals	$0.15	$0.03	$0.13	2	$0.08	$0.01
Sand and Gravel	$12.15	$0.22	$11.93	61	$7.57	$0.38
Total	$2,400.46	$627.97	$1,772.49	4,260	$920.87	$138.12

na = “not available”

Table A-6: Economic Data for the Steam Electric Sector, Region D(Year 2000)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Electric Services	$596.31	$154.61	$441.70	1044	$426.44	$76.37

na = “not available”

Attachment B: Distribution of Economic Impacts by County and Water User Group

Tables B-1 through B-5 show economic impacts by county and water user group; however, **caution** is warranted. Figures shown for specific counties are *direct* impacts only. For the most part, figures reported in the main text for all water use categories uses include *direct and secondary* impacts. Secondary effects were estimated using regional level multipliers that treat each regional water planning area as an aggregate and autonomous economy. Multipliers do not specify where secondary impacts will occur at a sub-regional level (i.e., in which counties or cities). All economic impacts that would accrue to a region as a whole due to secondary economic effects are reported in Tables B-1 through B-5 as "secondary regional level impacts."

For example, assume that in a given county (or city) water shortages caused significant reductions in output for a manufacturing plant. Reduced output resulted in lay-offs and lost income for workers and owners of the plant. This is a *direct* impact. Direct impacts were estimated at a county level; and thus one can say with certainty that direct impacts occurred in that county. However, secondary impacts accrue to businesses and households throughout the region where the business operates, and it is impossible using input-output models to determine where these businesses are located spatially.

The same logic applies to changes in population and school enrollment. Since employment losses and subsequent out-migration from a region were estimated using *direct* and *secondary* multipliers, it is impossible to say with any degree of certainty how many people a given county would lose regardless of whether the economic impact was direct or secondary. For example, assume the manufacturing plant referred to above is in County A. If the firm eliminated 50 jobs, one could state with certainty that water shortages in County A resulted in a loss of 50 jobs in that county. However, one could not unequivocally say whether 100 percent of the population loss due to lay-offs at the manufacturing would accrue to County A because many affected workers might commute from adjacent counties. This is particularly true in large metropolitan areas that overlay one or counties. Thus, population and school enrollment impacts cannot be reported at a county level.

Manufacturing

Table B-1: Distribution of Economic Impacts by County and Water User Groups: Manufacturing						
Lost Output (Total Sales, $millions)						
County	2010	2020	2030	2040	2050	2060
Cass						
Direct Impacts	$8.48	$11.87	$29.05	$34.14	$38.27	$45.65
Secondary Regional Level Impacts	$5.41	$7.57	$18.54	$21.79	$24.42	$29.13
Total	$13.89	$19.44	$47.58	$55.93	$62.70	$74.78
Job Losses (numbers may not sum to figures in text due to rounding)						
County	2010	2020	2030	2040	2050	2060
Cass						
Direct Impacts	31	44	107	126	141	168
Secondary Regional Level Impacts	53	74	180	212	238	284
Total	84	117	287	338	379	452
Income Losses ($millions)						
County	2010	2020	2030	2040	2050	2060
Cass						
Direct Impacts	$2.45	$3.42	$8.38	$9.85	$11.05	$13.17
Secondary Regional Level Impacts	$2.73	$3.82	$9.35	$10.99	$12.32	$14.70
Total	$5.18	$7.25	$17.74	$20.85	$23.37	$27.88
Business Taxes ($millions)						
County	2010	2020	2030	2040	2050	2060
Cass						
Direct Impacts	$0.08	$0.12	$0.29	$0.34	$0.38	$0.45
Secondary Regional Level Impacts	$0.10	$0.14	$0.34	$0.40	$0.45	$0.53
Total	$0.18	$0.26	$0.63	$0.74	$0.82	$0.98
Source: Texas Water Development Board, Office of Water Resources Planning						

Municipal

Impacts to the horticultural industry were estimated at the regional level only and are not included.

Table B-2: Lost Water Utility Revenues (Municipal)

County	2010	2020	2030	2040	2050	2060
Bowie	$0.64	$0.84	$1.00	$1.16	$1.23	$1.30
Cass	$0.12	$0.13	$0.13	$0.14	$0.14	$0.14
Gregg	$0.00	$0.17	$0.19	$0.21	$0.24	$0.28
Harrison	$0.00	$0.00	$0.06	$0.09	$0.12	$0.17
Hopkins	$0.04	$0.05	$0.06	$0.07	$0.07	$0.07
Hunt	$0.09	$0.10	$0.13	$0.15	$0.24	$0.39
Morris	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Rains	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Smith	$0.00	$0.00	$0.00	$0.00	$0.13	$0.50
Van Zandt	$0.25	$0.38	$0.50	$0.58	$0.71	$0.87
Wood	$0.26	$0.41	$0.48	$0.47	$0.46	$0.46
Total	$1.41	$2.08	$2.56	$2.88	$3.35	$4.19

Source: Texas Water Development Board, Office of Water Resources Planning

Table B-3: Lost Water Utility Taxes (Municipal)

County	2010	2020	2030	2040	2050	2060
Bowie	$0.01	$0.01	$0.02	$0.02	$0.02	$0.02
Cass	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Gregg	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Harrison	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Hopkins	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Hunt	$0.00	$0.00	$0.00	$0.00	$0.00	$0.01
Morris	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Rains	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Smith	$0.00	$0.00	$0.00	$0.00	$0.00	$0.01
Van Zandt	$0.00	$0.01	$0.01	$0.01	$0.01	$0.02
Wood	$0.00	$0.01	$0.01	$0.01	$0.01	$0.01
Total	$0.02	$0.04	$0.05	$0.05	$0.06	$0.07

Source: Texas Water Development Board, Office of Water Resources Planning

Table B-4: Costs Associated with Unmet Domestic Needs

County	2010	2020	2030	2040	2050	2060
Bowie	$1.84	$2.48	$2.98	$3.48	$3.71	$3.97
Cass	$0.27	$0.29	$0.30	$0.31	$0.30	$0.30
Gregg	$0.15	$0.17	$0.19	$0.21	$0.23	$0.26
Harrison	$0.00	$0.00	$0.22	$0.37	$0.56	$1.30
Hopkins	$0.09	$0.12	$0.14	$0.16	$0.16	$0.16
Hunt	$0.20	$0.22	$0.44	$1.04	$2.73	$7.17
Morris	$0.46	$0.46	$0.46	$0.46	$0.46	$0.46
Rains	$0.31	$0.60	$0.77	$0.81	$0.78	$0.74
Smith	$0.00	$0.00	$0.00	$0.00	$0.30	$1.10
Van Zandt	$0.54	$0.84	$1.10	$1.56	$2.30	$3.27
Wood	$0.58	$0.90	$1.06	$1.04	$1.02	$1.02
Total	$4.45	$6.08	$7.66	$9.44	$12.53	$19.75

Source: Texas Water Development Board, Office of Water Resources Planning

Steam Electric

Table B-5: Distribution of Economic Impacts by County and Water User Groups: (Steam Electric)						
Lost Output (Total Sales, $millions)						
County	2010	2020	2030	2040	2050	2060
Hunt						
Direct Impacts	$5.44	$6.62	$10.08	$14.30	$38.87	$45.15
Secondary Regional Level Impacts	$0.52	$0.63	$0.96	$1.36	$3.71	$4.30
Titus						
Direct Impacts	$130.09	$136.60	$152.09	$178.91	$211.61	$251.46
Secondary Regional Level Impacts	$12.40	$13.02	$14.50	$17.06	$20.17	$23.97
Total	$148.45	$156.88	$177.63	$211.63	$274.36	$324.88
Lost Income ($Millions)						
County	2010	2020	2030	2040	2050	2060
Hunt						
Direct Impacts	$3.89	$4.74	$7.21	$10.22	$27.80	$32.29
Secondary Regional Level Impacts	$1.12	$1.37	$2.08	$2.95	$8.02	$9.31
Titus						
Direct Impacts	$93.04	$97.69	$108.77	$127.95	$151.33	$179.83
Secondary Regional Level Impacts	$26.84	$28.18	$31.38	$36.91	$43.66	$51.88
Total	$124.89	$131.97	$149.44	$178.04	$230.80	$273.31
Lost Jobs (Numbers May Not Sum To Figures In Text Due To Rounding)						
	2010	2020	2030	2040	2050	2060
Hunt						
Direct Impacts	10	12	18	25	68	79
Secondary Regional Level Impacts	29	36	55	77	211	245
Titus						
Direct Impacts	228	239	266	313	371	440
Secondary Regional Level Impacts	705	740	824	970	1147	1363
Total	972	1,027	1,163	1,385	1,796	2,127
Lost Business Taxes ($Millions)						
County	2010	2020	2030	2040	2050	2060
Hunt						
Direct Impacts	$0.70	$0.85	$1.29	$1.83	$4.98	$5.78
Secondary Regional Level Impacts	$0.20	$0.24	$0.37	$0.53	$1.44	$1.67
Titus						
Direct Impacts	$16.66	$17.49	$19.48	$22.91	$27.10	$32.20
Secondary Regional Level Impacts	$4.81	$5.05	$5.62	$6.61	$7.82	$9.29
Total	$22.36	$23.63	$26.76	$31.88	$41.33	$48.95
Source: Texas Water Development Board, Office of Water Resources Planning						

Attachment C: Allocation of Economic Impacts by River Basin

Tables C-1 and C-2 distribute regional economic and social impacts by major river basin. Impacts were allocated based on distribution of water shortages among counties. For instance, if 50 percent of water shortages in River Basin A and 50 percent occur in River Basin then impacts were split equally among the two basins.

Manufacturing

All impacts associated with unmet water needs for manufacturers occur in the Sulphur River Basin.

Municipal

Table C-1: Distribution of Regional Impacts among Major River Basins (Municipal Uses)						
Lost Sales ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Cypress	$0.11	$0.11	$0.17	$0.18	$0.19	$0.30
Neches	$0.00	$0.00	$0.00	$0.00	$0.03	$0.07
Red	$0.18	$0.25	$0.29	$0.31	$0.27	$0.21
Sabine	$0.60	$1.13	$1.39	$1.53	$1.74	$2.32
Sulphur	$0.73	$0.88	$1.05	$1.29	$1.65	$1.89
Trinity	$0.00	$0.00	$0.01	$0.01	$0.02	$0.02
Total	$1.62	$2.37	$2.90	$3.32	$3.89	$4.80
Lost Income ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Cypress	$0.30	$0.41	$0.52	$0.64	$0.84	$1.32
Neches	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Red	$0.51	$0.70	$0.88	$1.09	$1.44	$2.25
Sabine	$1.70	$2.31	$2.91	$3.59	$4.76	$7.45
Sulphur	$2.06	$2.82	$3.54	$4.37	$5.80	$9.07
Trinity	$0.01	$0.01	$0.01	$0.01	$0.02	$0.03
Total	$4.58	$6.25	$7.86	$9.70	$12.86	$20.12
Job Losses (numbers may not sum to figures in text due to rounding)						
Basin	2010	2020	2030	2040	2050	2060
Cypress	0	0	1	1	1	1
Neches	0	0	0	0	0	0
Red	1	1	1	1	1	2
Sabine	2	3	3	4	5	6
Sulphur	2	3	4	5	6	7
Trinity	0	0	0	0	0	0
Total	5	7	8	11	13	15
Lost Business Taxes ($millions)						
Basin						
Cypress	$0.00	$0.00	$0.00	$0.00	$0.00	$0.01
Neches	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Red	$0.00	$0.00	$0.01	$0.01	$0.01	$0.01
Sabine	$0.01	$0.02	$0.02	$0.02	$0.03	$0.03
Sulphur	$0.01	$0.02	$0.02	$0.03	$0.03	$0.04
Trinity	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Total	$0.03	$0.04	$0.05	$0.06	$0.07	$0.09
Source: Texas Water Development Board, Office of Water Resources Planning						

Steam-electric

Table C-2: Distribution of Regional Impacts among Major River Basins (Steam-electric Uses)						
Lost Sales ($millions)						
Basin						
Cypress	$98.38	$92.76	$115.77	$146.40	$197.45	$240.39
Sabine	$50.08	$64.12	$61.86	$65.23	$76.91	$84.50
Total	$148.45	$156.88	$177.63	$211.63	$274.36	$324.88
Lost Income ($millions)						
Basin						
Cypress	$82.76	$78.04	$97.39	$123.16	$166.10	$202.23
Sabine	$42.13	$53.94	$52.04	$54.88	$64.70	$71.08
Total	$124.89	$131.97	$149.44	$178.04	$230.80	$273.31
Job Losses (numbers may not sum to figures in text due to rounding)						
Basin						
Cypress	644	607	758	958	1,293	1,574
Sabine	328	420	405	427	504	553
Total	972	1,027	1,163	1,385	1,796	2,127
Lost Business Taxes ($millions)						
Basin						
Cypress	$14.82	$13.97	$17.44	$22.06	$29.75	$36.22
Sabine	$7.54	$9.66	$9.32	$9.83	$11.59	$12.73
Total	$22.36	$23.63	$26.76	$31.88	$41.33	$48.95
Source: Texas Water Development Board, Office of Water Resources Planning						

MODEL WATER CONSERVATION PLAN

NETRWPG

GENERAL INFORMATION

Introduction

Water conservation includes those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses. As the prospect of acquiring new water source supplies is diminishing, Texans are realizing that saving the water we currently have is an important strategy for ensuring sufficient water supply for future generations. Even in the northeast Texas region, which is dotted with surface reservoirs and subsurface aquifers, water conservation is a vital tactic in the effort to protect our water resources.

Having well-managed and adequate water supplies is not only important for current residents of northeast Texas, but it also aids residential and commercial growth of the area, and encourages industry to locate in our region. If we are to remain in competition with metropolitan areas for residential and industrial growth, we must protect and preserve our natural resources, one of the most important being our water supplies. With this in mind, the Northeast Texas Regional Water Planning Group (NETRWPG) supports using water conservation as a water management strategy, and has developed this guidance to assist those in the region who are incorporating a water conservation plan into their system policies.

The holder of an existing permit, certified filing, or certificate of adjudication for the appropriation of surface water in the amount of 1,000 acre-feet a year or more for municipal…use shall develop, submit, and implement a water conservation plan meeting the requirements of Subchapter A of this chapter (relating to Water Conservation Plans). The water conservation plan must be submitted to the executive director not later than May 1, 2005. Thereafter, the next revision of the water conservation plan…must be submitted not later than May 1, 2009, and every five years after that date to coincide with the regional water planning group. Any revised plans must be submitted to the executive director within 90 days of adoption. The revised plans must include implementation reports. The requirement for a water conservation plan under this section must not result in the need for an amendment to an existing permit, certified filing, or certificate of adjudication. –TAC Chapter 288, Subchapter C

If you fall into one of the categories listed above, you are required to submit a plan to the TCEQ. Send your plan to the following address: TCEQ, Executive Director, Mail

Code 109, P.O. Box 13087, Austin, TX 78711-3087 for regular and certified mail, or 12100 Park 35 Circle, Austin, TX 78753 for express carrier deliveries (U.S. Post Office Express Mail, FedEx, UPS, etc.). If you do not fall into an above category, but are creating a plan for another reason, you are not required to submit your plan to TCEQ.

This guidance document was created using several reference materials, including Texas Administrative Code (TAC) Chapter 288, TAC Chapter 363, the Texas Water Development Board's (TWDB) 'Water Conservation Plan Guidance Checklist,' and the TWDB and Texas Commission on Environmental Quality (TCEQ) websites. Example wording that you may want to use in your plan will be included throughout in bold italics.

The __________________(water system) recognizes that water conservation is a viable strategy to protecting its water supply. This Water Conservation & Drought Contingency Plan (Plan) has been developed to protect the system's water source and extend its useful life in order to ensure that a sufficient water supply is available for both present and future needs. The water conservation portion of the Plan looks at year-round methods for reducing water use. It will consider methods that should result in a continuous reduction of water use. However, because some of the methods take place primarily in summer months, these impacts may be more noticeable on a seasonal basis. The drought contingency portion of the Plan will look at measures designed to reduce water use on a temporary basis in the event of a period of drought or an emergency situation such as water source contamination. Methods considered here are not necessarily needed on a continual basis, but should be achievable in the short term.

Though not required, it is helpful to users of your plan to include a description of your service area so that they can become familiar with the area you are working in. Following is a very general guideline.

The _________________ (water system) is located in ___________ County, along ______________ (give a general location using major highways or rivers). It is a rural community comprised of around ____ citizens. (Locate nearest bodies of water, important landmasses, etc.). ________'s (water system) water supply comes from ______________ (water rights, contract with…, etc. List contract amounts and lengths). __________ (water system) treats its own water, and also owns its own wastewater treatment facility.

It is also helpful to include in the introduction a detailed description of your water supply and your storage and distribution systems. You can summarize your systems here, but need to complete the TCEQ 'Utility Profile' form, which will provide specific system information.

All water conservation plans for municipal uses by public drinking water suppliers must include … a utility profile including, but not limited to, information regarding population and customer data, water use data, water supply system data, and wastewater system data. –TAC Chapter 288

Coordination with the Northeast Texas Regional Water Planning Group

The NETRWPG's Regional Water Plan contains population and water use projections for the next 50 years for all water systems within the northeast Texas region. We request that you review the latest version of this plan and use our projections in your plan. If you are unable to use our projections, please document your reasons.

In order to ensure that the water conservation plan is in agreement with the policies of the NETRWPG, we request that you submit a copy of your plan, once approved, to: NETRWPG, c/o Mr. Walt Sears, Northeast Texas Municipal Water District, P.O. Box 955, Hughes Springs, Texas 75656.

A copy of this plan was submitted to the NETRWPG on _________ (date).

Coordination with Wholesale Water Provider

If you purchase all or a portion of your supply from a wholesaler, then please include this section. If you own your own water rights, then disregard this section.

In order to create cohesive plans between water users, it is recommended that you review your wholesaler's water conservation plan before you create your own plan. You are not required to imitate the wholesaler's plan, but should not contradict it by your plan.

We have reviewed the _________________ (wholesale provider) water conservation plan and have created our plan to compliment that plan.

Coordination with the Public

The __________________________________(water supplier) gave the public an opportunity to provide input into this plan by ____________________________(public notice, public hearing, letter requesting comments, etc.). Public comments included ________________.

WATER CONSERVATION GOALS

All water conservation plans for municipal uses by public drinking water suppliers must include … beginning May 1, 2005, specific, quantified five-year and ten-year targets for water savings to include goals for water loss programs and goals for municipal use, in gallons per capita per day. The goals established by a public water supplier under this subparagraph are not enforceable. –TAC Chapter 288

The _____________ (water system) average daily water use is _______gpcpd according to ________ (source). The _____________ (water system) utilized Regional Water Planning Group projections when setting water savings goals. The system's 5-year goal for municipal use is to reduce daily water use (by/to) ___ gpcpd. Our water loss goal is ______________. The system's 10-year goal is to reduce daily water use (by/to) ___ gpcpd, thus achieving the projected ____ gpcpd by _____ (year) as stated in the Regional Water Plan. Our water loss goal is ____________.

PLAN FOR MEETING GOALS

Required Programs

Master Meter

All water conservation plans for municipal uses by public drinking water suppliers must include…metering devices with an accuracy of plus or minus 5.0% in order to measure and account for the amount of water diverted from the source of supply. –TAC Chapter 288

Discuss the type of master meter you currently have, and any plans for a new meter. If you cannot comply with the requirements, please explain.

Universal Metering

All water conservation plans for municipal uses by public drinking water suppliers must include…a program for universal metering of both customer and public uses of water… –TAC Chapter 288

Discuss your existing and/or proposed universal metering program. If you do not comply with these requirements, please explain.

Meter Testing & Repair Program

All water conservation plans for municipal uses by public drinking water suppliers must include…a program for meter testing and repair… –TAC Chapter 288

Discuss your existing and/or proposed meter testing and repair program. If you cannot comply with these requirements, please explain.

Meter Replacement Program

All water conservation plans for municipal uses by public drinking water suppliers must include…a program for periodic meter replacement. –TAC Chapter 288

Discuss plans for meter replacement. List any replacement schedules you have in place. If you do not have a meter replacement program, please explain.

Unaccounted for Water

All water conservation plans for municipal uses by public drinking water suppliers must include…measures to determine and control unaccounted-for uses of water (for example, periodic visual inspections along distribution lines; annual or monthly audit of the water system to determine illegal connections; abandoned services, etc.). –TAC Chapter 288

Discuss your existing and/or proposed measures to find and control unaccounted-for water use.

In addition to the examples above, many systems have water-billing programs that note accounts with higher than normal activity, which could be a water leak. If you have this program, please discuss it here.

Public Education and Information Program

All water conservation plans for municipal uses by public drinking water suppliers must include…a program of continuing public education and information regarding water conservation. –TAC Chapter 288

There are numerous ways to inform and educate the public about water conservation. Some examples include:

- Provide conservation pamphlets, available at City Hall or your water office. The TWDB offers some free and some for sale pamphlets on its website, www.twdb.state.tx.us.
- Add water conservation slogans to your monthly water bill, e.g., “Every drop counts – Be water smart!”; “Conserve water – It makes cents!”; “Please use the month of May to check your toilets for leaks.”
- Set up a water conservation booth at local fairs and festivals. Offer conservation oriented handouts.

- Sponsor a school project related to conservation in your local elementary school.
- Create a running banner on your website with water conservation tips that change periodically.
- Present a water conservation program at local service club meetings and industry group meetings.
- Offer field trips of your water treatment facility to local schools, and use the opportunity to talk about conservation
- Include "Keep Texas Beautiful" affiliate groups in conservation projects
- Encourage your agricultural extension agency to present Xeriscape programs to local high school horticulture classes, garden clubs, and other interested groups

Discuss your program for public awareness.

Non-promotional Water Rates

All water conservation plans for municipal uses by public drinking water suppliers must include…a water rate structure which is not "promotional," i.e., a rate structure which is cost-based and which does not encourage the excessive use of water. –TAC Chapter 288

Attach a copy of your water rates to the plan and summarize your rates here. If you need to impose a non-promotional water rate structure, or otherwise update your rates, discuss your plan here.

Reservoir systems operations plan

All water conservation plans for municipal uses by public drinking water suppliers must include…a reservoir systems operations plan, if applicable, providing for the coordinated operation of reservoirs owned by the applicant within a common watershed or river basin in order to optimize available water supplies. –TAC Chapter 288

If this section applies to you, discuss your plan here. If you do not comply, please explain.

Additional Programs

If necessary to meet the 5 and 10-year target goals, you can add any other water conservation strategies to your plan. They should be discussed in detail here, and can include, but are not limited to:

- Requiring structures undergoing substantial modification or addition to install water conserving plumbing fixtures

- Creating a program for the replacement or retrofit of water-conserving plumbing fixtures in existing structures
- Reusing and/or recycling of wastewater and/or graywater
- Creating a program for pressure control and/or reduction in the distribution system and/or for customer connections
- Creating a program and/or ordinance(s) for landscape water management

Wholesale Provider Requirement

Water conservation plans for municipal uses by public drinking water suppliers serving a current population of 5,000 or more and/or a projected population of 5,000 or more within the next ten years subsequent to the effective date of the plan must include the following elements: (A) a program of leak detection, repair, and water loss accounting for the water transmission, delivery, and distribution system in order to control unaccounted-for uses of water; (B) a record management system to record water pumped, water deliveries, water sales, and water losses which allows for the desegregation of water sales and uses into the following user classes: (i) residential; (ii) commercial; (iii) public and institutional; and (iv) industrial; and (C) a requirement in every wholesale water supply contract entered into or renewed after official adoption of the plan (by either ordinance, resolution, or tariff), and including any contract extension, that each successive wholesale customer develop and implement a water conservation plan or water conservation measures using the applicable elements in this chapter. If the customer intends to resell the water, the contract between the initial supplier and customer must provide that the contract for the resale of the water must have water conservation requirements so that each successive customer in the resale of the water will be required to implement water conservation measures in accordance with the provisions of this chapter. –TAC Chapter 288

If you are selling to a water provider who, in turn, intends to wholesale the water to a retail customer, your water supply contract, when renewed, must state that the subsequent wholesaler is required to have a water conservation plan in place. If this section applies, discuss the proposed contract changes here. If it does not apply, state why.

Schedule for meeting targets

In this section, please discuss your estimated timeline for implementing any programs noted in the “Required Program” section. For example, if you are proposing a meter replacement program, please discuss the schedule here.

Means of Implementation and Enforcement

All water conservation plans for municipal uses by public drinking water suppliers must include…a means of implementation and enforcement which shall be evidenced *by: (i) a copy of the ordinance, resolution, or tariff indicating official adoption of the water conservation plan by the water supplier; and (ii) a description of the authority by which the water supplier will implement and enforce the conservation plan. –TAC Chapter 288*

The ________________ (Mayor, President, etc.), or his/her designee, is hereby authorized to implement and enforce the water conservation plan.

The water conservation plan has made this plan official policy by means of a __________ (resolution, tariff, ordinance), passed on _______________ (date). A copy of the _______________ has been included at the end of the plan.

Means of tracking progress

Water conservation plans shall include the following elements: a method for tracking the implementation and effectiveness of the plan. –TAC Chapter 363

The ________________ (authorized representative) shall review average daily water use on a _______________ (monthly, quarterly, annual, etc.) basis to determine if water use reduction goals are being met. A summary of findings shall be made to the ___________ (governing body) at least every five years during plan updates.

Revision/Updates

Beginning May 1, 2005, a public water supplier for municipal use shall review and update its water conservation plan, as appropriate, based on an assessment of previous five-year and ten-year targets and any other new or updated information. The public water supplier for municipal use shall review and update the next revision of its water conservation plan not later than May 1, 2009, and every five years after that date to coincide with the regional water planning group. –TAC Chapter 288

The ______________ (authorized representative) shall be responsible for updating and revising this plan five years after its adoption, or May1, 2009, whichever is earlier.

PLAN FOR EMERGENCIES (DROUGHT CONTINGENCY)

A drought contingency plan is required as part of this plan. Please see the NETRWPG guidance documents for drought contingency plans, and use the one that is appropriate for you – either wholesale or retail.

MODEL DROUGHT CONTINGENCY PLAN

RETAIL WATER PROVIDERS

NETRWPG

GENERAL INFORMATION

Introduction

Drought is a very real natural disaster that occurs in Texas, even in the verdant bottomlands, green pastures, and piney woods of northeast Texas. As recently as 1996, drought strained water systems in the northeast Texas region, and caused some to wonder whether they would make it through the summer. In addition to natural drought, there are also water supply emergencies that occur from time to time in which water supply becomes contaminated. A good example of this is the recent MTBE spill into Lake Tawakoni, which contaminated supply for several Hunt County water systems for multiple days.

In an effort to better respond to drought conditions than we've been able to in the past, the Northeast Texas Regional Water Planning Group (NETRWPG) has prepared this document, with the idea that if water providers study their water supply system before a drought or emergency occurs, then they will be better prepared to respond. In preparing this document, several references were used, including Chapter 288 of the Texas Administrative Code, the Texas Commission on Environmental Quality's (TCEQ) 'Handbook for Drought Contingency Planning for Retail Public Water Suppliers,' Texas Water Code § 11.1272, and the TCEQ and TWDB websites. All of these resources are available to you if you need further information or clarification. You may also contact the TCEQ at 512-239-4691 with questions or for information. Example wording for your plan will be found throughout in bold italics.

According to the requirements set forth in Chapter 288, Subchapter C of the Texas Administrative Code, retail public water suppliers providing water service to 3,300 or more connections must submit a drought contingency plan to the executive director not later than May 1, 2005. Thereafter, retail public water suppliers providing service to 3,300 or more connections shall submit the next revision of the plan not later than May 1, 2009, and every five years after that date to coincide with the regional water planning group. Any new or revised plans must be submitted to the executive director within 90 days of adoption by the community water system. Any new retail public water suppliers providing water service to 3,300 or more connections shall prepare and adopt a drought contingency plan within 180 days of commencement of operation, and submit the plan to the executive director within 90 days of adoption. If you are a retail supplier, but serve less than 3,300 connections, you are still required to develop and implement a plan, but you do not need to submit the plan unless specifically requested by TCEQ. If you provide wholesale supply in addition to retail supply, you will also need to develop a wholesale drought contingency plan. Please see the Northeast Texas Region's guidance document for wholesale drought contingency plans.

The __________________(water provider) understands that water conservation is a viable strategy for protecting water resources both now and in the future, and that adequate planning for times of drought or emergency is a necessary part of conservation. The purpose of this plan is to prepare for the possibility of a drought or emergency situation where water is in short supply. This plan will help to ensure that _______________________(water supplier) uses water wisely and efficiently during periods of drought.

Though not specifically required by rule, it is helpful to the reader if you summarize your water supply and distribution systems in the introduction. This will familiarize users of the Plan with your system, and help them to make sense of the actions that you intend to take. In addition, discussing your water system here will assist those who update the plan in five years, because they will know exactly what the system looked like when the plan was created.

The ______________(water supplier) utilizes groundwater /surface water from _______________(source). Supply is secured by a (water right, water supply contract, etc.) through the year _____. We currently have _____ connections, and our average daily use is ____. Our storage and distribution systems consist of ____.

Coordination with the Northeast Texas Regional Water Planning Group

The drought contingency plan must document coordination with the regional water planning groups for the service area of the retail public water supplier to ensure consistency with the appropriate approved regional water plans. – TAC Chapter 288

A copy of this adopted plan will be submitted to the NETRWPG via its administrator, Mr. Walt Sears, Northeast Texas Municipal Water District, P.O. Box 955, Hughes Springs, Texas 75656.

Informing the Public/Requesting Input

Preparation of the plan shall include provisions to actively inform the public and to affirmatively provide opportunity for user input. Such acts may include, but are not limited to, having a public meeting at a time and location convenient to the public and providing written notice to the public concerning the proposed plan and meeting. – TAC Chapter 288

The _________________________________(water supplier) gave the public an opportunity to provide input into this plan by

__________________________(public notice, public hearing, letter requesting comments, etc.). Public comments included ________________.

Efforts to inform the public about each stage of the plan, and when stages are implemented or rescinded, will be through __________________________ (newspaper articles, radio announcements, website announcements, etc.).

Authorization/Applicability

The ________________ (mayor, president, city administrator, etc.) is hereby authorized to monitor the weather as well as water supply and demand conditions and to implement the Drought Contingency Plan as appropriate.

The _______________________(City Council, Board of Directors, etc.) authorizes the Plan by a _______________(resolution, ordinance), which has been included in this Plan.

Coordination with the Texas Commission on Environmental Quality

According to TAC Chapter 288, Subchapter C, "For retail public water suppliers providing water service to 3,300 or more connections, the drought contingency plan must be submitted to the executive director not later than May 1, 2005. Thereafter, the retail public water suppliers providing service to 3,300 or more connections shall submit the next revision of the plan not later than May 1, 2009, and every five years after that date to coincide with the regional water planning group. Any new or revised plans must be submitted to the executive director within 90 days of adoption by the community water system. Any new retail public water suppliers providing water service to 3,300 or more connections shall prepare and adopt a drought contingency plan within 180 days of commencement of operation, and submit the plan to the executive director within 90 days of adoption."

This plan was submitted to the executive director of the Texas Commission on Environmental Quality on _______________________(date).

Send your plan to the following address: TCEQ, Executive Director, Mail Code 109, P.O. Box 13087, Austin, TX 78711-3087 for regular and certified mail, or 12100 Park 35 Circle, Austin, TX 78753 for express carrier deliveries (U.S. Post Office Express Mail, FedEx, UPS, etc.).

If you serve less than 3,300 connections, the following rule applies:

For all the retail public water suppliers, the drought contingency plan must be prepared and adopted not later than May 1, 2005 and must be available for inspection by the executive director upon request. Thereafter, the retail public water suppliers shall prepare and adopt the next revision of the plan not later than May 1, *2009, and every five years after that date to coincide with the regional water planning group. Any new retail public water supplier providing water service to less than 3,300 connections shall prepare and adopt a drought contingency plan within 180 days of commencement of operation, and shall make the plan available for inspection by the executive director upon request. –TAC Chapter 288*

In other words, if you serve less than 3,300 connections, you are still required to prepare and adopt a plan, but you do not have to turn it in unless TCEQ asks for it. Your section would read:

Submission of this plan to the TCEQ was not required, however, the plan will be made available to TCEQ if requested.

For questions to the TCEQ, you can check the website at www.tceq.state.tx.us, or call:

- Water Systems with monitoring, technical and quality questions - 512/239-4691
- Consumer questions - 512/239-6100
- Water Rights information - 512/239-4691

Coordination with Wholesale Water Supplier

This section only applies if you purchase supply from a wholesale provider. If you have a contract or an agreement with a water provider, then complete this section. If you have water rights or otherwise own your supply, this section does not apply.

This plan has been created with our water provider, ________________'s drought contingency plan in mind. We have included __________________'s (water provider) requirements within our plan and have created this plan to compliment _____________'s (water provider) plan. ______________(water provider) has been provided a copy of this plan.

Plan Definitions

For the purposes of this Plan**,** the following definitions, taken from TCEQ guidance, shall apply:

Aesthetic water use: water use for ornamental or decorative purposes such as fountains, reflecting pools, and water gardens.

Commercial and institutional water use: water use which is integral to the operations of commercial and non-profit establishments and governmental entities such as retail establishments, hotels and motels, restaurants, and office buildings.

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

Customer: any person, company, or organization using water supplied by ________________ (name of water supplier).

Domestic water use: water use for personal needs or for household or sanitary purposes such as drinking, bathing, heating, cooking, sanitation, or for cleaning a residence, business, industry, or institution.

Even number address: street addresses, box numbers, or rural postal route numbers ending in 0, 2, 4, 6, or 8 and locations without addresses.

Industrial water use: the use of water in processes designed to convert materials of lower value into forms having greater usability and value.

Landscape irrigation use: water used for the irrigation and maintenance of landscaped areas, whether publicly or privately owned, including residential and commercial lawns, gardens, golf courses, parks, rights-of-way and medians.

Non-essential water use: water uses that are not essential nor required for the protection of public, health, safety, and welfare, including:

(a) irrigation of landscape areas, including parks, athletic fields, and golf courses, except otherwise provided under this Plan;
(b) use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle;
(c) use of water to wash down any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas;
(d) use of water to wash down buildings or structures for purposes other than immediate fire protection;
(e) flushing gutters or permitting water to run or accumulate in any gutter or street;
(f) use of water to fill, refill, or add to any indoor or outdoor swimming pools or jacuzzi-type pools;
(g) use of water in a fountain or pond for aesthetic or scenic purposes except where necessary to support aquatic life;
(h) failure to repair a controllable leak(s) within a reasonable period after having been given notice directing the repair of such leak(s); and
(i) use of water from hydrants for construction purposes or any other purposes other than fire fighting.

Odd numbered address: street addresses, box numbers, or rural postal route numbers ending in 1, 3, 5, 7, or 9.

RESPONSE TO A DROUGHT EVENT

In this portion of the plan, it will need to be determined whether a water constraint will more likely be caused by a shortage in water supply or by constraints in your storage and distribution system. Associated goals and water management measures should correspond to the type of constraint expected. For example, if insufficient storage is determined to be the most likely cause of water shortage during a drought, then an emergency back-up supply source would not solve the problem; reduced use during peak hours (banning lawn watering, etc.) would more likely solve the problem by giving storage tanks a better opportunity to refill.

The drought contingency plan should be designed for a drought condition at least as severe as the drought of record according to TCEQ rules. Since the drought of record in Texas occurred in the 1950's, few systems will have water use records still available to plan by. Therefore, the NETRWPG suggests using the most recent drought for the State, which occurred in 1996. If your system does not have records for 1996, use the time period in your records when your system was the most strained by dry weather conditions.

During each stage, it will need to be determined what will trigger initiation, what the water use reduction target goal is, what water management strategies will be put into place, and, finally, what will terminate the stage. Keep in mind that a supplier which is also a customer of its wholesale provider must comply with its provider's Drought Contingency Plan. Do not develop stages or management strategies that are in conflict with your water provider's DCP.

Stage 1 – Mild Water Shortage

Initiation: The ______________________(water supplier) will consider that a mild water shortage exists when_________________________________ (i.e. water levels in the reservoir reach_____; average daily water use reaches ___% of capacity for three consecutive days; water level in elevated storage tank is at or below ____ for more than 12 hours, etc***.), or when requested by __________*** (entity's water provider) if applicable.

Target Goal: When a mild water shortage exists, the ____________________(water supplier) will implement water management strategies in an attempt to reduce daily water use to __________________________(i.e. 2 MGD; ___% of average daily water use, etc.) Please note that this goal must be quantifiable. Goals established in this section are not enforceable.

Termination: Stage 1 shall be rescinded when ___________________________ (i.e. water levels in the reservoir rise above ___ for 7 consecutive days; average daily water use falls below ___% of capacity for three consecutive days; storage facilities return to normal levels for 24 consecutive hours, etc.), ***or when Stage I is rescinded by __________________________***(entity's water provider) if applicable.

Water Management Strategies: During Stage 1, we will take the following steps to reduce water use:_______________.

The following are examples of strategies that are commonly used during this stage. These are not mandatory, only suggestive. When determining strategies, remember the type of constraint you expect on your system and plan accordingly.

- Request voluntary water conservation from all customers
- Reduce operating procedures that use water (i.e. flushing of mains) as appropriate
- Cease providing potable water for dust control, road building and similar construction purposes
- Enhance water supply and demand monitoring, as well as leak detection and repair efforts
- Request that water customers voluntarily limit the irrigation of landscaped areas
- Request that non-essential water uses be eliminated, including:

  1. Wash down of any sidewalks, walkways, driveways, parking lots, or other hard-surfaced areas;
  2. Wash down of buildings or structures for purposes other than immediate fire protection;
  3. Use of water for dust control;
  4. Flushing gutters or permitting water to run or accumulate in any gutter or street; and
  5. Failure to repair a controllable leak(s) within a reasonable period after having been given notice directing the repair of such leak(s).

Stage 2 – Moderate Water Shortage

Initiation: The _______________________(water supplier) will consider that a moderate water shortage exists when___________________________________(i.e. water levels in the reservoir reach_____; average daily water use reaches ___% of capacity for three consecutive days; water level in elevated storage tank is at or below ____ for more than 12 hours, etc.), ***or when requested by __________*** (entity's water provider) if applicable.

Target Goal: When a moderate water shortage exists, the _____________________(water supplier) will implement water management strategies in an attempt to reduce daily water use to ____________________________(i.e. 2 MGD; ___% of average daily water use, etc.) Please note that this goal must be quantifiable. Goals established in this section are not enforceable.

Termination: Stage 2 shall be rescinded when _____________________________ (i.e. water levels in the reservoir rise above ___ for 7 consecutive days; average daily water use falls below ___% of capacity for three consecutive days; storage facilities return to normal levels for 24 consecutive hours, etc.), ***or when Stage 2 is rescinded by*** ___________________________(entity's water provider) if applicable. ***Upon termination of Stage 2, Stage 1 becomes operative.***

Water Management Strategies: During Stage 2, we will take the following steps to reduce water use:_______________.

The following are examples of strategies that are commonly used during this stage. These are not mandatory, only suggestive. When determining strategies, remember the type of constraint you expect on your system and plan accordingly.

- Modify reservoir operations if applicable
- Cease providing potable water for dust control, road building and similar construction purposes
- Enhance water supply and demand monitoring, as well as leak detection and repair efforts
- Limit use of water from hydrants to fire fighting, related activities, or other activities necessary to maintain public health, safety, and welfare
- Restrict irrigation of landscaped areas, for example, "Irrigation of landscape areas with hose-end sprinklers or automatic irrigation systems shall be prohibited except during the evening hours between 10:00 p.m. and 6:00 a.m. However, irrigation of landscaped areas is permitted at anytime if it is by means of a hand-held hose, a faucet filled bucket or watering can of five (5) gallons or less, or a drip irrigation system." Please consider your individual system when restricting landscape watering. Allow watering when other types of water use are low to prevent strain on your system. Only use even/odd water days if you know it will work for your system – this type of watering plan can sometimes encourage lawn watering that otherwise wouldn't take place.
- Prohibit use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle. Vehicle washing may be done at any time on the immediate premises of a commercial car wash or commercial service station.
- Prohibit use of water to fill, refill, or add to any indoor or outdoor swimming pools, wading pools, or Jacuzzi-type pools.
- Prohibit operation of any ornamental fountain or pond for aesthetic or scenic purposes except where necessary to support aquatic life.
- Prohibit non-essential water uses such as:

    1. Wash down of any sidewalks, walkways, driveways, parking lots, or other hard-surfaced areas;
    2. Wash down of buildings or structures for purposes other than immediate fire protection;
    3. Use of water for dust control;
    4. Flushing gutters or permitting water to run or accumulate in any gutter or street;
    5. Failure to repair a controllable leak(s) within a reasonable period after having been given notice directing the repair of such leak(s).

Stage 3 – Severe Water Shortage

Initiation: The _______________________(water supplier) will consider that a severe water shortage exists when__________________________________(i.e. water levels in the reservoir reach_____; average daily water use reaches ___% of capacity for three consecutive days; water level in elevated storage tank is at or below ____ for more than 12 hours, etc.), ***or when requested by*** __________ (entity's water provider) if applicable.

Target Goal: When a severe water shortage exists, the ____________________(water supplier) ***will implement water management strategies in an attempt to reduce daily water use to*** __________________________(i.e. 2 MGD; ___% of average daily water use, etc.) Please note that this goal must be quantifiable. Goals established in this section are not enforceable.

Termination: Stage 3 shall be rescinded when ____________________________ (i.e. water levels in the reservoir rise above ___ for 7 consecutive days; average daily water use falls below ___% of capacity for three consecutive days; storage facilities return to normal levels for 24 consecutive hours, etc.), ***or when Stage 3 is rescinded by*** ___________________________(entity's water provider) if applicable. ***Upon termination of Stage 3, Stage 2 becomes operative.***

Water Management Strategies: During Stage 3, we will take the following steps to reduce water use:_______________.

The following are examples of strategies that are commonly used during this stage. These are not mandatory, only suggestive. When determining strategies, remember the type of constraint you expect on your system and plan accordingly.

- All of the strategies in Stage 2 are appropriate in Stage 3, except that landscape watering may need to be prohibited
- Implement water rate surcharges *(i.e. a set charge for any use above average monthly use)*
- Implement price adjustments *(i.e. increase the price per 1,000 gallons of water used above the average monthly use)*
- Utilize alternate or emergency water sources

Stage 4 – Emergency Water Shortage

This Stage could apply in the instance of a major water line break, a contamination of the water supply source, or other urgent water system conditions. Most likely, this stage would be initiated by decision of the authorized plan implementer (Mayor, President, Manager, etc.)

Initiation: The ______________________(water supplier) will consider that an emergency water shortage exists when_________________________________ (i.e. the water main at the water treatment plant bursts or is otherwise significantly damaged; the reservoir is contaminated by oil spill; etc.,), ***or when requested by __________*** (entity's water provider) if applicable.

Target Goal: When an emergency water shortage exists, the ____________________(water supplier) will implement water management strategies in an attempt to reduce daily water use to __________________________(i.e. 2 MGD; ___% of average daily water use, etc.) Please note that this goal must be quantifiable. Goals established in this section are not enforceable.

Termination: Stage 4 shall be rescinded when ___________________________ (i.e. the main at the water treatment plant is restored and storage tanks have been allowed to refill; analysis of the source water indicates that supply is safe to use; etc.), ***or when Stage 4 is rescinded by __________________________***(entity's water provider) if applicable.

Water Management Strategies: During Stage 4, we will take the following steps to reduce water use:_______________.

The following are examples of strategies that are commonly used during this stage. These are not mandatory, only suggestive. When determining strategies, remember the type of constraint you expect on your system and plan accordingly.

- Utilize alternative or emergency water supplies (i.e. tying into a neighboring water system, etc. (This may require approval by the TCEQ Executive Director)
- Modify reservoir operations
- All strategies that are used in Stage 3 could be applicable in Stage 4

PLAN EXECUTION

Public Involvement

This section should discuss the ways in which the supplier will inform its customers about the initiation and termination of drought stages, as well as management strategies that customers are expected to follow. Public involvement can be in the form of special public hearings, articles and notices in the local newspaper, radio announcements, announcements on local television stations, notices in billing statements, etc.

The _____________________ (water provider) will keep its customers apprised of initiation of the drought contingency plan, and changes in stages, by means of __________________________.

Enforcement

The _______________ (Mayor, City Manager, President, etc.), or his/her designee, is responsible for monitoring weather conditions and water supply and determining when to initiate and terminate the stages of the DCP.

The ________________ (governing body) ***has adopted this plan through ___________*** (ordinance, resolution), ***and has made it an official _________*** (city, Corporation, etc.) ***policy. The ________________*** (ordinance, resolution, etc.) ***is attached hereto as Figure ___.***

Provision for responding to wholesale provider restrictions

Any water supplier that receives all or a portion of its water supply from another water supplier shall consult with that supplier and shall include in the drought contingency plan appropriate provisions for responding to reductions in that water supply. –TAC Chapter 288

If you have a wholesale provider, then add this section. If you own your own supply, please skip this section.

As stated in each water shortage stage, we intend to comply with all requirements of our wholesale provider's drought contingency plan. This plan is as stringent as our provider's plan, and in some cases may be more so.

Notification of TCEQ on mandatory provisions

A wholesale or retail water supplier shall notify the executive director within five business days of the implementation of any mandatory provisions of the drought contingency plan. –TAC Chapter 288

The Executive Director at TCEQ shall be notified with 5 business days if any mandatory provisions of this plan are implemented. The Executive Director can be reached at 512-239-3900.

Variance procedures

The drought contingency plan must include procedures for granting variances to the plan. –TAC Chapter 288

The ______________ (authorized representative) may, in writing, grant temporary variance for existing water uses otherwise prohibited under this Plan if it is determined that failure to grant such variance would cause an emergency condition adversely affecting the health, sanitation, or fire protection for the public or the

customer requesting such variance and if one or more of the following conditions are met:

a) ***Compliance with this Plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the Plan is in effect.***

b) ***Alternative methods can be implemented which will achieve the same level of reduction in water use.***

Customers requesting an exemption from the provisions of this Plan shall file a petition for variance with the ______________ (water supplier) within 5 days after the Plan or a particular drought response stage has been invoked. All petitions for variances shall be reviewed by the _________ (authorized representative), and shall include the following:

a) ***Name and address of the petitioner(s).***
b) ***Purpose of water use.***
c) ***Specific provision(s) of the Plan from which the petitioner is requesting relief.***
d) ***Detailed statement as to how the specific provision of the Plan adversely affects the petitioner or what damage or harm will occur to the petitioner or others if petitioner complies with this Ordinance.***
e) ***Description of the relief requested.***
f) ***Period of time for which the variance is sought.***
g) ***Alternative water use restrictions or other measures the petitioner is taking or proposes to take to meet the intent of this Plan and the compliance date.***
h) ***Other pertinent information.***

Variances granted by the _______________ (water supplier) shall be subject to the following conditions, unless waived or modified:

a) ***Variances granted shall include a timetable for compliance.***
b) ***Variances granted shall expire when the Plan is no longer in effect, unless the petitioner has failed to meet specified requirements.***

No variance shall be retroactive or otherwise justify any violation of this Plan occurring prior to the issuance of the variance.

5-year updates

The retail public water supplier shall review and update, as appropriate, the drought contingency plan, at least every five years, based on new or updated information, such as the adoption or revision of the regional water plan. –TAC Chapter 288

This plan shall be revaluated and updated every five years based on updated information; especially the latest adopted NETRWPG Regional Water Plan.

MODEL DROUGHT CONTINGENCY PLAN

WHOLESALE WATER PROVIDERS

NETRWPG

GENERAL INFORMATION

Introduction

Drought is a very real natural disaster that occurs in Texas, even in the verdant bottomlands, green pastures, and piney woods of northeast Texas. As recently as 1996, drought strained water systems in the northeast Texas region, and caused some to wonder whether they would make it through the summer. In addition to natural drought, there are also water supply emergencies that occur from time to time in which water supply becomes contaminated. A good example of this is the recent MTBE spill into Lake Tawakoni, which contaminated supply for several Hunt County water systems for multiple days.

In an effort to better respond to drought conditions than we've been able to in the past, the Northeast Texas Regional Water Planning Group (NETRWPG) has prepared this document, with the idea that if water providers study their water supply system before a drought or emergency occurs, then they will be better prepared to respond. In preparing this document, several references were used, including Chapter 288 of the Texas Administrative Code, the Texas Commission on Environmental Quality's (TCEQ) 'Handbook for Drought Contingency Planning for Wholesale Public Water Suppliers,' Texas Water Code § 11.1272, and the TCEQ and TWDB websites. All of these resources are available to you if you need further information or clarification. You may also contact the TCEQ at 512-239-4691 with questions or for information. Example wording for your plan will be found throughout in bold italics.

According to the requirements set forth in Chapter 288, Subchapter C of the Texas Water Code, wholesale public water suppliers must prepare and submit a drought contingency plan to the Executive Director of the Texas Commission on Environmental Quality. If you provide retail supply in addition to wholesale supply, you will also need to develop a retail drought contingency plan. Please see the Northeast Texas Region's guidance for retail drought contingency plans.

The __________________(water provider) understands that water conservation is a viable strategy for protecting water resources both now and in the future, and that adequate planning for times of drought or emergency is a necessary part of conservation. The purpose of this plan is to prepare for the possibility of a drought or emergency situation where water is in short supply. This plan will help to ensure

that ________________________(water supplier) and its wholesale customers use water wisely and efficiently during periods of drought.

Though not specifically required by rule, it is helpful to the reader if you summarize your water supply and distribution systems in the introduction. This will familiarize users of the Plan with your system, and help them to make sense of the actions that you intend to take. In addition, discussing your water system here will assist those who update the plan in five years, because they will know exactly what the system looked like when the plan was created.

The _______________(water supplier) utilizes <u>groundwater /surface water</u> from ________________(source). Supply is secured by a (water right, water supply contract, etc.) through the year _____. Our customers include ____________________________, and their current contracted amounts are ______. Our storage and distribution systems consist of ____.

Coordination with the Northeast Texas Regional Water Planning Group

The drought contingency plan must document coordination with the regional water planning groups for the service area of the wholesale public water supplier to ensure consistency with the appropriate approved regional water plans. – TAC Chapter 288

A copy of this adopted plan will be submitted to the NETRWPG via its administrator, Mr. Walt Sears, Northeast Texas Municipal Water District, P.O. Box 955, Hughes Springs, Texas 75656. Proof of submittal is attached hereto as Figure ___.

Informing the Public/Requesting Input

According to TAC Chapter 288, Subchapter B.a.1, “Preparation of the plan shall include provisions to actively inform the public and to affirmatively provide opportunity for user input in the preparation of the plan and for informing wholesale customers about the plan. Such acts may include, but are not limited to, having a public meeting at a time and location convenient to the public and providing written notice to the public concerning the proposed plan and meeting.”

The ___________________________________(water supplier) gave the public and its wholesale customers an opportunity to provide input into this plan by ____________________________(public notice, public hearing, letter requesting comments, etc.). Public comments included _________________.

Efforts to inform wholesale customers and the public about each stage of the plan, and when stages are implemented or rescinded, will be through ____________________________ (certified letter, newspaper articles, radio announcements, website announcements, etc.).

Authorization/Applicability

The ________________ (mayor, president, city administrator, etc.) is hereby authorized to monitor weather conditions as well as water supply and demand conditions and to implement the Drought Contingency Plan as appropriate.

The _______________________(City Council, Board of Directors, etc.) authorizes the Plan by a _______________(resolution, ordinance), which has been included in this Plan.

Coordination with the Texas Commission on Environmental Quality

According to TAC Chapter 288, Subchapter C, "Wholesale public water suppliers shall submit a drought contingency plan meeting the requirements of Subchapter B of this chapter to the executive director not later than May 1, 2005, after adoption of the drought contingency plan by the governing body of the water supplier. Thereafter, the wholesale public water suppliers shall submit the next revision of the plan not later than May 1, 2009, and every five years after that date to coincide with the regional water planning group. Any new or revised plans must be submitted to the executive director within 90 days of adoption by the governing body of the wholesale public water supplier."

This plan was submitted to the executive director of the Texas Commission of Environmental Quality on _______________________(date).

Send your plan to the following address: TCEQ, Executive Director, Mail Code 109, P.O. Box 13087, Austin, TX 78711-3087 for regular and certified mail, or 12100 Park 35 Circle, Austin, TX 78753 for express carrier deliveries (U.S. Post Office Express Mail, FedEx, UPS, etc.).

For questions to the TCEQ, you can check their official website at www.tceq.state.tx.us, or call:

- Water Systems with monitoring, technical and quality questions - 512/239-4691
- Consumer questions - 512/239-6100
- Water Rights information - 512/239-4691

Coordination with Wholesale Water Supplier

This section only applies if you purchase supply from a wholesale provider. If you have a contract or agreement with a water provider, then complete this section. If you have your own water rights or otherwise own your supply, this section does not apply.

This plan has been created with our water provider, ________________'s drought contingency plan in mind. We have included __________________'s (water provider) requirements within our plan and have created this plan to compliment _____________'s (water provider) plan. ______________(water provider) has been provided a copy of this plan.

Plan Definitions

For the purposes of this Plan**,** the following definitions, taken from TCEQ guidance, shall apply:

Aesthetic water use: water use for ornamental or decorative purposes such as fountains, reflecting pools, and water gardens.

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

Customer: any person, company, or organization using water supplied by _________________ (name of water supplier).

Domestic water use: water use for personal needs or for household or sanitary purposes such as drinking, bathing, heating, cooking, sanitation, or for cleaning a residence, business, industry, or institution.

Even number address: street addresses, box numbers, or rural postal route numbers ending in 0, 2, 4, 6, or 8 and locations without addresses.

Industrial water use: the use of water in processes designed to convert materials of lower value into forms having greater usability and value.

Landscape irrigation use: water used for the irrigation and maintenance of landscaped areas, whether publicly or privately owned, including residential and commercial lawns, gardens, golf courses, parks, rights-of-way and medians.

Non-essential water use: water uses that are not essential nor required for the protection of public, health, safety, and welfare, including:

(a) irrigation of landscape areas, including parks, athletic fields, and golf courses, except otherwise provided under this Plan;

(b) use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle;
(c) use of water to wash down any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas;
(j) use of water to wash down buildings or structures for purposes other than immediate fire protection;
(k) flushing gutters or permitting water to run or accumulate in any gutter or street;
(l) use of water to fill, refill, or add to any indoor or outdoor swimming pools or jacuzzi-type pools;
(m) use of water in a fountain or pond for aesthetic or scenic purposes except where necessary to support aquatic life;
(n) failure to repair a controllable leak(s) within a reasonable period after having been given notice directing the repair of such leak(s); and
(o) use of water from hydrants for construction purposes or any other purposes other than fire fighting.

Odd numbered address: street addresses, box numbers, or rural postal route numbers ending in 1, 3, 5, 7, or 9.

RESPONSE TO A DROUGHT EVENT

In this portion of the plan, it will need to be determined whether a water constraint will more likely be caused by a shortage in water supply or by constraints in the storage and distribution system. Associated goals and water management measures should correspond to the type of constraint expected. For example, if insufficient storage is determined to be the most likely cause of water shortage during a drought, then an emergency back-up supply source would not solve the problem; reduced use during peak hours (banning lawn watering, etc.) would more likely solve the problem by giving storage tanks a better opportunity to refill.

The drought contingency plan should be designed for a drought condition at least as severe as the drought of record according to TCEQ rules. Since the drought of record in Texas occurred in the 1950's, few systems will have water use records still available to plan by. Therefore, the NETRWPG suggests using the most recent drought for the State, which occurred in 1996. If your system does not have records for 1996, use the time period in your records when your system was the most strained by dry weather conditions.

The drought contingency plan must include a minimum of three drought or emergency response stages providing for the implementation of measures in response to water supply conditions during a repeat of the drought-of-record. –TAC Chapter 288

The drought contingency plan must include specific, quantified targets for water use reductions to be achieved during periods of water shortage and drought. The entity preparing the plan shall establish the targets. The goals established by the entity under this paragraph are not enforceable. –TAC Chapter 288

A minimum of three drought stages is required in this plan. During each stage, it will need to be determined what will trigger initiation, what the water use reduction target goal is, what water management strategies will be put into place, and, finally, what will terminate the stage. Keep in mind that a supplier who is also a customer of its wholesale provider must comply with its provider's Drought Contingency Plan. Do not develop stages or management strategies that are in conflict with your water provider's DCP. Also note that the NETRWPG has developed water management strategies for all providers who are projected to have a water shortage within the planning period (50 years). You should review the latest version of the Regional Water Plan to determine if you have had strategies prepared for you.

Include an opening paragraph in this section that describes what information should be monitored in order to initiate the stages, and a rationale of why you chose the triggering criteria that you chose.

The drought contingency plan must include a provision in every wholesale water contract entered into or renewed after adoption of the plan, including contract extensions, that in case of a shortage of water resulting from drought, the water to be distributed shall be divided in accordance with Texas Water Code, §11.039. –TAC Chapter 288

Texas Water Code, §11.039 states, "DISTRIBUTION OF WATER DURING SHORTAGE. (a) If a shortage of water in a water supply not covered by a water conservation plan prepared in compliance with Texas Natural Resource Conservation Commission or Texas Water Development Board rules results from drought, accident, or other cause, the water to be distributed shall be divided among all customers pro rata, according to the amount each may be entitled to, so that preference is given to no one and everyone suffers alike. (b) If a shortage of water in a water supply covered by a water conservation plan prepared in compliance with Texas Natural Resource Conservation Commission or Texas Water Development Board rules results from drought, accident, or other cause, the person, association of persons, or corporation owning or controlling the water shall divide the water to be distributed among all customers pro rata, according to: (1) the amount of water to which each customer may be entitled; or (2) the amount of water to which each customer may be entitled, less the amount of water the customer would have saved if the customer had operated its water system in compliance with the water conservation plan.(c) Nothing in Subsection (a) or (b) precludes the person, association of persons, or corporation owning or controlling the water from supplying water to a person who has a prior vested right to the water under the laws of this state.

Stage 1 – Mild Water Shortage

Initiation: The ______________________(name of water supplier) will consider that a mild water shortage exists when_________________________________ (i.e. water levels in the reservoir reach_____; average daily water use reaches ___% of capacity for three consecutive days; water level in elevated storage tank is at or below ____ for more than 12 hours, etc.)***, or when requested by __________*** (entity's water provider) if applicable**.**

Target Goal: When a mild water shortage exists, the ____________________(water supplier) will implement water management strategies in an attempt to reduce daily water use to __________________________ (i.e. 2 MGD; ___% of average daily water use, etc.) Please note that this goal must be quantifiable. Goals established in this section are not enforceable.

Termination: Stage 1 shall be rescinded when ___________________________ (i.e. water levels in the reservoir rise above ___ for 7 consecutive days; average daily water use falls below ___% of capacity for three consecutive days; storage facilities return to normal levels for 24 consecutive hours, etc.)***, or when Stage I is rescinded by ___________________________*** (entity's water provider) if applicable**.**

Water Management Strategies: During Stage 1, we will take the following steps to reduce water use:_______________.

The following are examples of strategies that are commonly used during this stage. These are not mandatory, only suggestive. When determining strategies, remember the type of constraint you expect on your system and plan accordingly.

The drought contingency plan must include the specific water supply or water demand management measures to be implemented during each stage of the plan including, but not limited to, the following: (A) pro rata curtailment of water deliveries to or diversions by wholesale water customers as provided in Texas Water Code, §11.039; and (B) utilization of alternative water sources with the prior approval of the executive director as appropriate, e.g. interconnection with another water system, temporary use of a non-municipal water supply, use of reclaimed water for non-potable purposes, etc.). –TAC Chapter 288

- Request voluntary water conservation from all customers
- Recommend that customers initiate Stage 1 of their Drought Contingency Plans
- Reduce operating procedures that use water (i.e. flushing of mains) as appropriate

Stage 2 – Moderate Water Shortage

Initiation: The _______________________(water supplier) will consider that a moderate water shortage exists when__________________________________(i.e. water levels in the reservoir reach_____; average daily water use reaches ___% of capacity for three consecutive days; water level in elevated storage tank is at or below ____ for more than 12 hours, etc.)***, or when requested by __________ (entity's water provider)*** if applicable.

Target Goal: When a moderate water shortage exists, the ____________________(water supplier) will implement water management strategies in an attempt to reduce daily water use to __________________________ (i.e. 2 MGD; ___% of average daily water use, etc.) Please note that this goal must be quantifiable. Goals established in this section are not enforceable.

Termination: Stage 2 shall be rescinded when ____________________________ (i.e. water levels in the reservoir rise above ___ for 7 consecutive days; average daily water use falls below ___% of capacity for three consecutive days; storage facilities return to normal levels for 24 consecutive hours, etc.)***, or when Stage 2 is rescinded by __________________________*** (entity's water provider) if applicable. ***Upon termination of Stage 2, Stage 1 becomes operative.***

Water Management Strategies: During Stage 2, we will take the following steps to reduce water use:_______________.

The following are examples of strategies that are commonly used during this stage. These are not mandatory, only suggestive. When determining strategies, remember the type of constraint you expect on your system and plan accordingly.

The drought contingency plan must include the specific water supply or water demand management measures to be implemented during each stage of the plan including, but not limited to, the following: (A) pro rata curtailment of water deliveries to or diversions by wholesale water customers as provided in Texas Water Code, §11.039; and (B) utilization of alternative water sources with the prior approval of the executive director as appropriate, e.g. interconnection with another water system, temporary use of a non-municipal water supply, use of reclaimed water for non-potable purposes, etc.). –TAC Chapter 288

- Recommend that customers initiate Stage 2 of their Drought Contingency Plans, which should, at a minimum, contain lawn watering restrictions
- Modify reservoir operations if applicable

- Initiate strong public awareness campaign in service area to warn of impending shortages

Stage 3 – Severe Water Shortage

Initiation: The ______________________(water supplier) will consider that a severe water shortage exists when _________________________________(i.e. water levels in the reservoir reach_____; average daily water use reaches ___% of capacity for three consecutive days; water level in elevated storage tank is at or below ____ for more than 12 hours, etc.)***, or when requested by*** __________ (entity's water provider) if applicable***.***

Target Goal: When a severe water shortage exists, the ____________________(water supplier) will implement water management strategies in an attempt to reduce daily water use to __________________________ (i.e. 2 MGD; ___% of average daily water use, etc.) Please note that this goal must be quantifiable. Goals established in this section are not enforceable.

Termination: Stage 3 shall be rescinded when ___________________________ (i.e. water levels in the reservoir rise above ___ for 7 consecutive days; average daily water use falls below ___% of capacity for three consecutive days; storage facilities return to normal levels for 24 consecutive hours, etc.)***, or when Stage 3 is rescinded by*** __________________________ (entity's water provider) if applicable***. Upon termination of Stage 3, Stage 2 becomes operative.***

Water Management Strategies: During Stage 3, we will take the following steps to reduce water use:_______________.

The following are examples of strategies that are commonly used during this stage. These are not mandatory, only suggestive. When determining strategies, remember the type of constraint you expect on your system and plan accordingly.

The drought contingency plan must include the specific water supply or water demand management measures to be implemented during each stage of the plan including, but not limited to, the following: (A) pro rata curtailment of water deliveries to or diversions by wholesale water customers as provided in Texas Water Code, §11.039; and (B) utilization of alternative water sources with the prior approval of the executive director as appropriate, e.g. interconnection with another water system, temporary use of a non-municipal water supply, use of reclaimed water for non-potable purposes, etc.). –TAC Chapter 288

- Recommend that customers initiate Stage 3 of their Drought Contingency Plans, which, at a minimum, must include a ban on lawn watering
- Begin pro rata water allocation (Pro rata curtailment of water deliveries to or diversions by wholesale water customers must be considered in a wholesale DCP

according to TAC Chapter 288, Subchapter B. Rules for pro rata curtailment are provided in Texas Water Code, §11.039.)

- Implement water rate surcharges (i.e. a set charge for any use above average monthly use)
- Implement price adjustments (i.e. increase the price per 1,000 gallons of water used above the average monthly use)
- Utilize alternate or emergency water sources

Stage 4 – Emergency Water Shortage

This Stage could apply in the instance of a major water line break, a contamination of the water supply source, or other urgent water system conditions. Most likely, this stage would be initiated by decision of the authorized plan implementer (Mayor, President, Manager, etc.)

Initiation: The _______________________(water supplier) will consider that an emergency water shortage exists when___________________________________ (i.e. the water main at the water treatment plant bursts or is otherwise significantly damaged; the reservoir is contaminated by oil spill; etc.,)***, or when requested by ___________*** (entity's water provider) if applicable.

Target Goal: When an emergency water shortage exists, the _____________________(water supplier) will implement water management strategies in an attempt to reduce daily water use to ___________________________ (i.e. 2 MGD; ___% of average daily water use, etc.) Please note that this goal must be quantifiable. Goals established in this section are not enforceable.

Termination: Stage 4 shall be rescinded when ____________________________ (i.e. the main at the water treatment plant is restored and storage tanks have been allowed to refill; analysis of the source water indicates that supply is safe to use; etc.), ***or when Stage 4 is rescinded by ____________________________***(entity's water provider) if applicable.

Water Management Strategies: During Stage 4, we will take the following steps to reduce water use:________________.

The following are examples of strategies that are commonly used during this stage. These are not mandatory, only suggestive. When determining strategies, remember the type of constraint you expect on your system and plan accordingly.

The drought contingency plan must include the specific water supply or water demand management measures to be implemented during each stage of the plan including, but not limited to, the following: (A) pro rata curtailment of water deliveries to or diversions by wholesale water customers as provided in Texas Water Code, §11.039; and (B) utilization of alternative water sources with the prior approval of the executive director *as appropriate, e.g. interconnection with another water system, temporary use of a non-municipal water supply, use of reclaimed water for non-potable purposes, etc.). –TAC Chapter 288*

- Utilize alternative or emergency water supplies (i.e. tying into a neighboring water system, etc. This may require approval by the TCEQ Executive Director)
- Modify reservoir operations
- Strategies listed in Stage 3

PLAN EXECUTION

Public Involvement

This section should discuss the ways in which the supplier will inform its wholesale customers about the initiation and termination of drought stages, as well as management strategies that customers are expected to follow. Public involvement can be in the form of special public hearings, articles and notices in the local newspaper, radio announcements, announcements on local television stations, notices in billing statements, etc.

The ______________________ (water provider) will keep its customers apprised of initiation of the drought contingency plan, and changes in stages, by means of ___________________________.

Enforcement

The ______________ (Mayor, City Manager, President, etc.), or his/her designee, is responsible for monitoring weather conditions and water supplies, and determining when to initiate and terminate stages of the DCP.

The drought contingency plan must include procedures for the enforcement of any mandatory water use restrictions including specification of penalties (e.g., liquidated damages, water rate surcharges, discontinuation of service) for violations of such restrictions. –TAC Chapter 288, Subchapter B.a.10.

The _______________ *(governing body)* **has adopted this plan through ___________** *(ordinance, resolution),* **and has made it an official _________** *(city, Corporation, etc.)* **policy. The _______________** *(ordinance, resolution, etc.)* **is attached hereto as Figure ___.**

Provision for responding to wholesale provider restrictions

Any water supplier that receives all or a portion of its water supply from another water supplier shall consult with that supplier and shall include in the drought *contingency plan appropriate provisions for responding to reductions in that water supply. –TAC Chapter 288*

If you have a wholesale provider, then add this section. If you own your own supply, please skip this section.

As stated in each water shortage stage, we intend to comply with all requirements of our wholesale provider's drought contingency plan. This plan is as stringent as our provider's plan, and in some cases may be more so.

Notification of TCEQ on mandatory provisions

A wholesale or retail water supplier shall notify the executive director within five business days of the implementation of any mandatory provisions of the drought contingency plan. –TAC Chapter 288

The Executive Director at TCEQ shall be notified with 5 business days if any mandatory provisions of this plan are implemented. The Executive Director can be reached at 512-239-3900.

Variance procedures

The drought contingency plan must include procedures for granting variances to the plan. –TAC Chapter 288

The _____________ (authorized representative) may, in writing, grant temporary variance for existing water uses otherwise prohibited under this Plan if it is determined that failure to grant such variance would cause an emergency condition adversely affecting the health, sanitation, or fire protection for the public or the customer requesting such variance and if one or more of the following conditions are met:

c) ***Compliance with this Plan cannot be technically accomplished during the duration of the water supply shortage or other condition for which the Plan is in effect.***

d) ***Alternative methods can be implemented which will achieve the same level of reduction in water use.***

Customers requesting an exemption from the provisions of this Plan shall file a petition for variance with the ______________ (water supplier) within 5 days after the Plan or a particular drought response stage has been invoked. All petitions for variances shall be reviewed by the _________ (authorized representative), and shall include the following:

a) *Name and address of the petitioner(s).*
b) *Purpose of water use.*
c) *Specific provision(s) of the Plan from which the petitioner is requesting relief.*
d) *Detailed statement as to how the specific provision of the Plan adversely affects the petitioner or what damage or harm will occur to the petitioner or others if petitioner complies with this Ordinance.*
e) *Description of the relief requested.*
f) *Period of time for which the variance is sought.*
g) *Alternative water use restrictions or other measures the petitioner is taking or proposes to take to meet the intent of this Plan and the compliance date.*
h) *Other pertinent information.*

Variances granted by the _______________ (water supplier) shall be subject to the following conditions, unless waived or modified:

a) ***Variances granted shall include a timetable for compliance.***
b) ***Variances granted shall expire when the Plan is no longer in effect, unless the petitioner has failed to meet specified requirements.***

No variance shall be retroactive or otherwise justify any violation of this Plan occurring prior to the issuance of the variance.

5-year updates

The retail public water supplier shall review and update, as appropriate, the drought contingency plan, at least every five years, based on new or updated information, such as the adoption or revision of the regional water plan. –TAC Chapter 288

This plan shall be revaluated and updated every five years based on updated information; especially the latest adopted NETRWPG Regional Water Plan.

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(903) 758-2099

SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group _________ ***North East Texas*** ___________

Political Subdivision (WUG or WWP) ____ ***Linden, City of*** ________________

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7***
Groundwater, Carrizo-Wilcox	2000-2010	$334,574	040358000
TOTAL COST OF CAPITAL IMPROVEMENTS		$334,574	

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☑ ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

____

____

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and
2) Percent share of the total cost to be met by each funding source.

☐ %__________ Cash Reserves
☑ % 100 Bonds
☐ %__________ Bank Loans
☐ %__________ Federal Government Programs
☐ %__________ State Government Programs
☐ %__________ Other____________________
% 100 *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

____

____

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

John E. Erwin	City Clerk	903-756-7502
Name	Title	Phone

FAX BACK TO
HAYES ENGINEERING
(903) 758-2099

SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group ___ ***North East Texas*** ___

Political Subdivision (WUG or WWP) ___ ***Liberty City WSC*** ___

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7***
Groundwater, Carrizo-Wilcox	2000-2010	$2,061,991	044232000
TOTAL COST OF CAPITAL IMPROVEMENTS		$2,061,991	

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☑ ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

___

___

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and
2) Percent share of the total cost to be met by each funding source.

- ☑ % 10% Cash Reserves
- ☐ % ___ Bonds
- ☐ % 90% Bank Loans
- ☐ % ___ Federal Government Programs
- ☐ % ___ State Government Programs
- ☐ % ___ Other ___
- % ___ *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

___

___

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or Implementation.

Person Completing this Form:

Max J. Conlin	Gen Mgr	903-984-9593
Name	Title	Phone

SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group ***North East Texas***

Political Subdivision (WUG or WWP) ***West Gregg SUD***

Recommended Project/Strategy	Implementation Date	Capital Cost to be paid by Political Subdivision	ID# from DBO7
Groundwater, Carrizo-Wilcox	2000-2010	$1,477,930	044382000
TOTAL COST OF CAPITAL IMPROVEMENTS		$1,477,930	

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☒ ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1) Funding source(s)[1] by checking the corresponding box(es) and
2) Percent share of the total cost to be met by each funding source.

- ✓ % 25 Cash Reserves
- ✓ % 25 Bonds
- ✓ % 25 Bank Loans
- ✓ % 25 Federal Government Programs
- ☐ % ____ State Government Programs
- ☐ % ____ Other ____
- % 100 *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Name	Title	Phone
Rocky Stegner	Manager	903-983-1816

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(903) 758-2099

SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group D ***North East Texas***

Political Subdivision (WUG or WWP) ***Lindale Rural WSC***

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7***
Groundwater, Carrizo-Wilcox	2000-2010	$310,781	044234000
TOTAL COST OF CAPITAL IMPROVEMENTS		$310,781	

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?
☑ ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:
1) Funding source(s)[1] by checking the corresponding box(es) and
2) Percent share of the total cost to be met by each funding source.

☐ %____ Cash Reserves
☐ %____ Bonds
☐ %____ Bank Loans
☑ % 100 Federal Government Programs
☐ %____ State Government Programs
☐ %____ Other
% 100 *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

USDA

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Sam Beeler	General Manager	903-882-3335
Name	Title	Phone

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(903) 758-2099

SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group ______ ***North East Texas*** ______

Political Subdivision (WUG or WWP) ______ ***Star Mountain WSC*** ______

Recommended Project/Strategy	Implementation Date	Capital Cost to be paid by Political Subdivision	ID# from DB07
Groundwater, Carrizo-Wilcox	2000-2010	$310,781	040757212
TOTAL COST OF CAPITAL IMPROVEMENTS		$310,781	

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☑ ***YES*** ☐ ***NO***

If 'no,' describe how you will meet your future water needs.

______

______

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:
1) Funding source(s)[1] by checking the corresponding box(es) and
2) Percent share of the total cost to be met by each funding source.

☐ % ______ Cash Reserves
☐ % ______ Bonds
☐ % ______ Bank Loans
☐ % 50% Federal Government Programs
☐ % 50% State Government Programs
☐ % ______ Other ______
% ______ *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

______

ORCA

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Name	Title	Phone
Kerry Roberts	Office Mgr	903-352-0114

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SURVEY TO OBTAIN INFRASTRUCTURE FINANCING INFORMATION FROM POLITICAL SUBDIVISIONS WITH NEEDS

(Information to be completed before survey is sent)

Regional Water Planning Group ________ ***North East Texas*** ________

Political Subdivision (WUG or WWP) ________ ***Mineola, City of*** ________

Recommended Project/Strategy	***Implementation Date***	***Capital Cost to be paid by Political Subdivision***	***ID# from DBO7***
Groundwater, Carrizo-Wilcox	2000-2010	$238,912	040406000
TOTAL COST OF CAPITAL IMPROVEMENTS		$238,912	

(Information to be provided by the Political Subdivision)

Are you planning to implement the recommended projects/strategies?

☐ ***YES*** ☒ ***NO***

If 'no,' describe how you will meet your future water needs.

Please See Attached Sheet

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:
1) Funding source(s)[1] by checking the corresponding box(es) and
2) Percent share of the total cost to be met by each funding source.

☐ %________ Cash Reserves
☐ %________ Bonds
☐ %________ Bank Loans
☐ %________ Federal Government Programs
☐ %________ State Government Programs
☐ %________ Other________________
%________ *TOTAL – (Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

____

____

[1]Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

Person Completing this Form:

Name	Title	Phone
Ronnie Bradley	Dir. of Water Utilities	903-569-3987

June 16, 2005

The City of Mineola in September 2004 came on line with a new water well and 500,000 gallon ground storage tank. The water well produces 650 gpm. The city has plans to construct a new 500,000 gallon elevated storage tank to replace an out dated 300,000 gallon tank. We are at this time seeking a location for a future water well test hole site. The test hole would not be developed into a well untill needed. The city does have water conservation saving regulations in our plumbing ordiance. I hope this updated information will be of benefit.

City of Mineola
By

Ronnie Bradley

Ronnie Bradley
Director of Water/ Wastewater Collection

Appendix B - Table of Contents

Chapter 10 Appendix - Adoption of Plan & Public Participation

Attachment
North East Texas Regional Water Plan – Region D

LEVEL 1. Comments and questions *must be satisfactorily addressed* in order to meet statutory, agency rule, and/or contract requirements.

Executive Summary

1. Page 1-53 Table 1.16: Revise 2000 water-use estimates to ensure consistency with the DB07 (DB07). [*Title 31, Texas Administrative Code (TAC) §357.7(a)(1)(B)*]. It appears the numbers used in the report are from a TWDB water-use estimate report produced prior to the release of the draft water-use estimates and projections for the 2006 Regional Water Plans.
   We revised the year-2000 figures to TWDB approved usage amounts.

2. Page v, Paragraph 2 and Chapter 1, Page 1-53: In the second paragraph beginning with, "In 2000, total reported usage…", the total 2000 groundwater and surface water usage is cited as being 470,840 acre-feet but the amount in DB07 is 487,815 acre-feet. Please revise to ensure consistency with DB07. [*Title 31*, *TAC §357.7(a)(1)(B)*]. **Revised to match water usage amount in DB07.**

3. Executive Summary and Page 1-53, untitled tables: Revise the following use amounts to ensure consistency with DB07. *[Title 31, TAC §357.7(a)(1)(B)]*

Category	**Region D, Exec. Summary, Page V – 2000 Use**	**DB07**
Municipal	144,519	111,537
Manufacturing	196,807	253,206
Power	71,694	73,477
Mining	7,463	7,532
Irrigation	15,187	15,486
Livestock	35,169	26,577

Tables were revised following final inputs to DB07 to ensure match between written plan and the database. Please refer to Table 1.16 in the January 5, 2006 Water Plan.

4. Executive Summary, Page vi, Paragraph 3: Please revise the 2000 census population from 704,000 to the TWDB approved value of 704,171. *[Title 31*, *TAC §357.7(a)(1)(B)]*

Population quote was changed to exactly match TWDB approved value.

5. Executive Summary, Page vi, Paragraph 5, third sentence: Revise the reported per capita use figures, as appropriate. [*Title 31*, *TAC §357.7(a)(1)(B)*] The text states that the Region D average daily per capita use in the 2000 was 137 gallons and the statewide average daily per capita use was 160 gallons. Using figures from DB07, the average daily per capita use for Region D was 141 gallons (2000 municipal use =

111,537 acre-feet, 2000 population = 704,171). The actual figure for the statewide average daily per capital use was 173 gallons (2000 municipal use = 4,047,321 acre-feet, 2000 population = 20,851,790). Please correct the average daily per capita use figures.

Per capita use values were corrected.

Chapter 1: Planning Area Description

6. Table 1.15: Delineate water use by basin, if the county is split by river basin. *[Title 31, TAC §357.7(a)(3)(A)(iv)]*

Revised Table 1.15 delineating water use by basin attached to this document.

7. Chapter 1, Page 1-52, Table 1.15 and Chapter 1, Page 1-53, Table 1.16: The 2000 county total usage data do not match the 2000 TWDB approved numbers. [*Title 31, TAC §357.7(a)(3)(A)(iv)*]. The usage amounts in these two tables appear to be from the initial TWDB estimates (pre-2nd Planning Cycle), and should be updated to reflect the final TWDB approved data. In Table 1.15, please change the year-2000 figures to TWDB approved usage amounts. For Table 1.16, the TWDB has not produced a revised set of 2000 water use estimates by groundwater and surface water sources. Consider illustrating groundwater-surface water usage in percentages of the whole rather than by numbers that do not match those in the rest of the plan.

Revised Table 1.15 attached to this document.
Table 1.16: We revised the year-2000 figures to TWDB approved usage amounts. Please refer to Table 1.16 in the January 5, 2006 Water Plan.

Chapter 2: Population and Water Demand Projections

8. Appendix to Chapter 2, first unnumbered page after Table 2.19, "County Other Population Projections" – Various Counties: Correct the following data discrepancies [*Title 31, TAC §357.7(a)(3)(A)(iv)*] outlined below:

- Bowie County: The Macedonia-Eylua MUD #1 is listed in the Red River Basin in the table, but listed in the Sulphur River Basin in the DB07 and in Table 2.19, earlier in the Appendix to Chapter 2.

The basin location of this WUG was corrected to Sulphur River Basin.

- Camp County: The population projections for Bi-County WSC and Sharon WSC are different than the TWDB-approved projections as shown in the earlier Table 2.19 and in the DB07 (see below).

•Bi-County WSC, Camp County, Cypress Basin

Source	**P2000**	**P2010**	**P2020**	**P2030**	**P2040**	**P2050**	**P2060**
IPP	4,739	5,397	6,127	6,802	7,336	7,750	8,204
TWDB	4,739	5,694	7,127	8,452	9,501	10,314	11,205

•Sharon WSC, Camp County, Cypress Basin

Source	**P2000**	**P2010**	**P2020**	**P2030**	**P2040**	**P2050**	**P2060**

IPP	58	66	75	83	90	95	100
TWDB	58	74	84	94	102	108	115

Data discrepancies corrected to correspond to TWDB-approved projections. Please refer to Appendix A of the January 5, 2006 Water Plan.

- Franklin County: The population projections for the Cypress Springs WSC and the Tri WSC are different than the TWDB-approved projections, as show in the earlier Table 2.19 and in the DB07 (see below). The DB07 lists Franklin County-portion of Tri WSC entirely within the Cypress River Basin and not within the Sulphur River Basin. In addition, the North Hopkins WSC is included in Franklin County, Sulphur River Basin in the DB07, but is not included in the table. If the region decides to transfer population and water demand between river basins, but within the same county, please contact TWDB staff to make adjustments in the DB07.

•Cypress Springs WSC, Franklin County, Cypress River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	4,037	4,979	5,810	6,379	6,947	6,947	6,947
TWDB	4,293	5,295	6,179	6,783	7,387	7,387	7,387

• Cypress Springs WSC, Franklin County, Sulphur River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	657	811	946	1,038	1,131	1,131	1,131
TWDB	699	862	1,006	1,104	1,203	1,203	1,203

•Tri WSC, Franklin County, Cypress River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	123	152	177	195	212	212	212
TWDB	132	163	190	208	227	227	227

• Tri WSC, Franklin County, Sulphur River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	67	82	96	105	115	115	115
TWDB	n/a	n/a	n/a	n/a	n/a	n/a	n/a

• North Hopkins WSC, Sulphur River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TWDB	60	73	85	93	101	101	101

Data discrepancies corrected to correspond to TWDB-approved projections. Please refer to Appendix A of the January 5, 2006 Water Plan

- Harrison County: The population projections for the Gum Springs WSC are different than the TWDB-approved projections as shown in the earlier Table 2.19 and in the DB07 (see below).

•Gum Springs WSC, Harrison County, Cypress River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	4,774	5,443	6,106	6,585	6,946	7,368	7,990
TWDB	650	741	831	897	946	1,003	1,088

•Gum Springs WSC, Harrison County, Sabine River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	650	741	831	897	946	1,003	1,088
TWDB	4,774	5,443	6,106	6,585	6,946	7,368	7,990

TWDB numbers are correct, IPP numbers have been revised to match the TWDB numbers for Gum Springs WSC

- Hopkins County: Sharon WSC (Cypress River Basin) is not included, although it is in the earlier Table 2.19 and in the DB07. The other non-city WUGs (Cash WSC, N. Hopkins WSC and Cypress Springs WSC) are included.

Sharon WSC is a WUG, and is listed in Table 2.19

- Hunt County: The population projections for the Combined Consumers WSC, the Campbell WSC, the Cash WSC, the Hickory Creek SUD, the Macbee WSC, and the Community Water Co. are different than the TWDB-approved projections, as shown in the earlier Table 2.19 and in the DB07 (see below). In addition, the Caddo Basin SUD is not included in the Hunt County table, although it is included in the earlier Table 2.19.

•Community Water Company, Hunt County, Sabine River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	767	767	767	767	767	767	767
TWDB	774	774	774	774	774	774	774

•Combined Consumers WSC, Hunt County, Sabine River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP[1]	733	733	733	733	733	733	733
IPP[2]	6,051	6,998	8,677	11,101	15,110	24,142	38,267
TWDB	6,110	6,999	8,656	11,048	15,003	23,844	37,701

[1]One or more systems in the WSC described as “No Growth Entities”.
[2]Described as the Tawakoni system

•Campbell WSC, Hunt County, Sabine River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	1,186	1,371	1,700	2,175	2,961	4,730	7,498
TWDB	185	244	357	521	794	1,406	2,367

•Cash WSC, Hunt County, Sabine River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	11,586	13,400	16,615	21,256	28,932	46,226	73,273
TWDB	11,699	13,401	16,574	21,155	28,728	45,657	72,191

•Hickory Creek SUD, Hunt County, Sabine River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	340	393	488	624	850	1,357	2,152
TWDB	344	394	487	621	844	1,341	2,120

•Macbee WSC, Hunt County, Sabine River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	351	406	503	643	876	1,399	2,218
TWDB	354	406	502	640	870	1,382	2,185

•Campbell WSC, Hunt County, Sulphur River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TWDB	278	366	535	782	1,192	2,110	3,550

•Hickory Creek SUD, Hunt County, Sulphur River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	1,507	1,743	2,162	2,766	3,964	6,015	9,534
TWDB	1,522	1,744	2,156	2,752	3,738	5,940	9,393

•North Hunt WSC, Hunt County, Sulphur River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	2,274	2,630	3,261	4,173	5,679	9,074	14,383
TWDB	2,296	2,631	3,253	4,153	5,639	8,962	14,171

•Caddo Basin SUD, Hunt County, Sulphur River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TWDB	40	45	56	72	97	155	245

•Hickory Creek SUD, Hunt County, Sulphur River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	160	185	229	293	399	637	1,010
TWDB	161	185	228	291	396	629	995

Data discrepancies corrected to correspond to TWDB-approved projections. Please refer to Appendix A of the January 5, 2006 Water Plan.

- Rains County: The population projections for the Cash WSC is slightly different than the TWDB-approved projections, as shown in the earlier Table 2.19 and in the DB07 (see below).

•Cash WSC, Rains County, Sabine River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	539	669	803	889	913	907	890
TWDB	539	668	803	889	913	906	891

Data discrepancies corrected to correspond to TWDB-approved projections. Please refer to Appendix A of the January 5, 2006 Water Plan.

- Titus County: The population projections for the Tri WSC is different than the TWDB-approved projections, as shown in the earlier Table 2.19 and in the DB07 (see below). The DB07 does not show any population served by the Tri WSC in the Sulphur River Basin. Please change the numbers to match the DB07 or, if the transfer of population between river basins is desired, please coordinate with TWDB staff to provide relevant data in a tabular, electronic format to ensure that the Plan is compatible with the DB07.

•Tri WSC, Titus County, Cypress River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	5,188	5,874	6,593	7,329	7,834	8,294	8,689
TWDB	5,189	5,873	6,592	7,328	7,832	8,291	8,686

Data discrepancies corrected to correspond to TWDB-approved projections. Please refer to Appendix A of the January 5, 2006 Water Plan.

•Tri WSC, Titus County, Sulphur River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	3,460	3,918	4,398	4,888	5,225	5,532	5,795
TWDB	n/a	n/a	n/a	n/a	n/a	n/a	n/a

In DB07, this population is part of the County-Other, Titus County, Sulphur River basin. Please refer to Appendix A of the January 5, 2006 Water Plan.

9. Appendix to Chapter 2, first unnumbered page after Table 2.20, "County Other Demand Projections" – Various Counties: The sum of the County-Other entities does not equal the County-Other demand projections as shown in the earlier Table 2.20 and in the DB07. Correct the following data discrepancies [*Title 31, TAC §357.7(a)(3)(A)(iv)*] outlined below:

- Bowie County:

	2010	2020	2030	2040	2050	2060
Sum of IPP County-Other Demand Projections	5,435	6,145	6,774	7,397	7,863	8,365
TWDB	4,086	4,250	4,335	4,413	4,332	4,287

Demand projections include Red River Redevelopment Authority's (RRRA) demands in the Sulphur River basin. The authority is requesting for a TCEQ permit to draw water from two local lakes. Please refer to Bowie County-Other demand projections, Appendix A of the January 5, 2006 Water Plan.

- Camp County:

	2010	2020	2030	2040	2050	2060
Sum of IPP County-Other Demand Projections	336	356	374	390	402	416
TWDB	296	224	159	109	70	27

Table 2.20 and DB07 should be revised to correspond to the referenced unnumbered page, by changing the population shown in Camp County Other (Cypress) to correspond to population shown in the first unnumbered pages after Table 2.19.

- Cass County:

	2010	2020	2030	2040	2050	2060
Sum of IPP County-Other Demand Projections	2,525	2,625	2,726	2,826	2,826	2,750
TWDB	2,489	2,589	2,690	2,790	2,790	2,790

- Franklin County:

	2010	2020	2030	2040	2050	2060
Sum of IPP County-Other Demand Projections	220	246	265	281	281	281
TWDB	211	235	252	268	268	268

Data discrepancies corrected to correspond to TWDB-approved projections. Please refer to Appendix A of the January 5, 2006 Water Plan.

- Hopkins County:

	2010	2020	2030	2040	2050	2060
Sum of IPP County-Other Demand Projections	1,303	1,431	1,491	1,524	1,395	1,280
TWDB	1,293	1,419	1,476	1,510	1,382	1,266

Data discrepancies corrected to correspond to TWDB-approved projections. Please refer to Appendix A of the January 5, 2006 Water Plan.

- Hunt County

	2010	2020	2030	2040	2050	2060
Sum of IPP County-Other Demand Projections	1,291	1,545	1,908	2,489	3,853	5,997
TWDB	1,350	1,600	1,962	2,541	3,911	6,063

Data discrepancies corrected to correspond to TWDB-approved projections. Please refer to Appendix A of the January 5, 2006 Water Plan.

- Lamar County:

	2010	2020	2030	2040	2050	2060
Sum of IPP County-Other Demand Projections	254	267	283	297	291	285
TWDB	255	267	281	298	291	284

Data discrepancies corrected to correspond to TWDB-approved projections. Please refer to Appendix A of the January 5, 2006 Water Plan.

- Red River County:

	2010	2020	2030	2040	2050	2060
Sum of IPP County-Other Demand Projections	470	464	458	453	453	453
TWDB	493	486	480	473	473	473

Data discrepancies corrected to correspond to TWDB-approved projections. Please refer to Appendix A of the January 5, 2006 Water Plan

- Van Zandt County:

	2010	2020	2030	2040	2050	2060
Sum of IPP County-Other Demand Projections	3,246	3,735	4,147	4,454	4,849	5,285
TWDB	3,240	3,727	4,138	4,447	4,839	5,276

Data discrepancies corrected to correspond to TWDB-approved projections. Please refer to Appendix A of the January 5, 2006 Water Plan.

Chapter 3: Water Supply Analysis

10. Delineate supplies and availability of Wholesale Water Providers by county, water use category, and river basin. *[Title 31, TAC §357.7(a)(3)(B)]*

Additional charts were added to show Wholesale Water Providers.

11. Section 3.1, Page 3-4, Table 3.2: Water Rights should be noted for each availability source. *[Contract, Exhibit "B", Section 3.3]*

12. All water supply tables: Water supplies should be delineated by county as well as basin. *[Contract, Exhibit "B", Section 3.1.1]*

Additional charts were added to show water supply delineated by county and basin.

13. Chapter 3, page 3-11. shows minor deviations from DB07 data noted for the 2006 Carrizo-Wilcox, and Woodbine aquifer (2010-2060) availability estimates. Please ensure that numbers in the text and DB07 are reconciled. [*Contract, Exhibit "B", Section 3.2.2*]

Numbers in DB07 and text have been reconciled.

14. Page 3-12 to 3-13, Table 3.7: The counties and total pumpage data reported for use of "other aquifers" in Table 3.7 differs from statements made on page 1-32. Please reconcile the information in the text and table. [*Contract, Exhibit "B", Section 2.2*]

Information has been revised to match.

15. Appendix A, Chapter 3 reports a groundwater availability estimate is listed for Delta County from the Woodbine aquifer. Per TWDB aquifer map, the Woodbine aquifer does not extend under Delta County. Please verify this availability estimate. [*Contract, Exhibit "B", Section 3.1.1*]

Chapter 4: Identification, Evaluation, and Selection of Water Management Strategies Based on Needs

16. Appendix A, Chapter 4: Please quantify the reliability of all water sources. *[Title 31, TAC §357.7(a)(8)(A)(i)]*

Added "Reliability of Source" column to the Strategy Recommendation Summary table.

17. Chapter 4, pages 4-44 to 4-86: Drought contingency must be recommended as a water management strategy for certain water user groups with a need and must be considered for all water user groups with a need. If not recommended, please provide reasons for not adopting drought management strategies for each water user group with a need. *[Title 31, TAC §357.7(a)(7)(B) and Texas Water Code 11.1272]*

Page 4-48, 4.7(d), 2nd paragraph describes the process for choosing Water Management Strategies for the region.

18. Describe the process used to identify potentially feasible strategies approved by the planning group. *[Title 31, TAC §357.5(e)(4)]*

Process is included in Chapter 4, 4.7 (d). Please refer to the January 5, 2006 Water Plan.

19. Page 4-13: Include details of all Wholesale Water Provider contractual and non-contractual obligations. *[Contract, Exhibit "B", Section 5.1]*

Details of all Wholesale Water Provider contractual and non-contractual obligations are shown in Table 4.23 through table 4.38. Please refer to the January 5, 2006 Water Plan.

20. Appendix A: Include calculations of interest during construction in the costs estimates of water management strategies. *[Contract, Exhibit "B", Section 4.2.9]* The interest during construction as calculated was based on 3 percent and no construction periods are shown. TWDB's Exhibit B 4.2.9 item (d) page 54 states: "Interest during construction is the total of interest accrued at the end of the construction period using a 6 percent annual interest rate on total borrowed funds, less a 4 percent rate of return on investment of unspent funds."

Calculations of interest during construction have been included in the cost estimates of water management strategies. Please refer to WUG cost worksheets in Appendix A of the January 5, 2006 Water Plan.

21. Appendix A: Include the cost of power in the cost estimates for water management strategies. *[Contract, Exhibit "B", Section 4.2.9]* For example, some of the Water Management Strategoes involve wells to pump groundwater from the Carrizo-Wilcox aquifer but power costs are not specifically shown.

Cost of power has been included in the cost estimates for water management strategies. Please refer to WUG cost worksheets in Appendix A of the January 5, 2006 Water Plan.

22. The report should quantitatively report reliabilities of water delivered and treated for end user requirements. *[Title 31, TAC §357.7(a)(8)(A)(i)]*

Reliabilities of water are shown in the Chapter 4 Appendix, Strategy Recommendation Summary to 2060. Please refer to Appendix A of the January 5, 2006 Water Plan.

23. The following omissions in the analysis for Water Management Strategies should be addressed: *[Title 31, TAC §357.7(a)(5)(A) and §357.7(a)(5)(B)]*

- Water availability and needs analysis are not shown for Leary in Bowie County.

This WUG does not have a shortage. Please refer to the WUG module in DB07. Also, the WUG is listed in Table 4.39 of the January 5, 2006 Water Plan.

- No strategy is included for Caddo Basin SUD in Hunt County or Franklin County Water District.

This WUG does not have a shortage. Caddo Basin SUD is listed in Table 4.39 of the January 5, 2006 Water Plan.

- Prairie Creek Reservoir and pipeline are mentioned in the Executive Summary and elsewhere, but are not fully evaluated.
- Page 4-42, paragraph 3 and page 4-70: There is not an analysis of movement of water to the Upper Sabine River Basin from Toledo Bend.

An analysis has been included in the Chapter 4 Appendix - Evaluation of Water Management Strategies, Hunt County. Please refer to Appendix A of the January 5, 2006 Water Plan.

24. Appendix A, Chapter 4, "Cost Savings Analysis" worksheets:

- A Cost-Saving Analysis for the Red River Redevelopment Authority should be included in the "Region D Evaluation of Water Management Strategies" Section of this chapter. *[Title 31, TAC §357.14(2)(B)]*

An analysis has been included in the Chapter 4 Appendix - Evaluation of Water Management Strategies, Bowie County. Please refer to Appendix A of the January 5, 2006 Water Plan.

- Column 12 of these worksheets incorrectly show cost for conservation savings as a sum. Individual savings measures must be weighted based on the total amount saved per measure. *[Title 31, TAC §357.14(2)(B)]*

Individual savings measures were weighted based on the total amount saved per measure. Please refer to WUG Conservation Worksheets in the Appendix A of the January 5, 2006 Water Plan.

- Include analysis worksheets for all appropriate entities.

Cost savings analysis worksheets have been included for all entities with shortage. Please refer to Appendix A of the January 5, 2006 Water Plan.

Chapter 7: Description of how the Regional Plan is Consistent with Long-Term Protection of the State's Water Resources, Agricultural Resources, and Natural Resources

25. The report should indicate how the plan protects water contracts, option agreements, and special water resources. [*Title 31, TAC §357.5(e)(3)*]

Page 7-1, first paragraph describes how the plan protects water contracts, option agreements and special water resources.

Overall Requirements

26. Appendix C, Supplemental Tasks – Per Capita Water Use Differences: Include median income data for Como, Lindale, and New Boston for the supplemental Per Capita Use Study. [*Contract Exhibit "C", Supplemental Task Funding, Task A(e)*]

Median income for Como is $25,962. Information on median income for Lindale and New Boston included in Appendix C of the January 5, 2006 Water Plan.

27. Appendix C, Supplemental Tasks - Per Capita Water Use Differences: The information cited as being from the Initially Prepared Plan (IPP) differs from what is actually included in the IPP and from the DB07. [*Title 31, TAC §357.7(a)(3)(A)(iv)*] The "IPP Reported" figures should be corrected as noted below:

- City of Como section, first unnumbered page:

	Appendix C – Supplemental Tasks	Appendix A – Chapter 2 Appendix	TWDB Approved Figures
IPP Reported 2000 Water Use	139 MG (426.7 acre-feet)	n/a	26 MG (80 acre-feet)
IPP Reported 2000 Population	932	621	621
IPP Calculated Per Capita Water Use	410	115	115

City population and demand includes 311 persons served outside the city limits. Revised tables attached to this document.

- City of Greenville section, first unnumbered page:

	Appendix C – Supplemental Tasks	Appendix A – Chapter 2 Appendix	TWDB Approved Figures
IPP Reported 2000 Water Use	1,812 MG (5,562.8 acre-feet)	n/a	1,809.8 MG (5,556 acre-feet)
IPP Reported 2000 Population	24,596	23,960	23,960
IPP Calculated Per Capita Water Use	202	207	207

Figures were corrected to correspond to TWDB approved figures. Please refer to Appendix C, Supplemental Tasks, of the January 5, 2006 Water Plan.

- City of Greenville section, the first unnumbered page and Page 4 of the water audit page: On the fourth page of the water audit form, question #10 – Other (Usage), the total of the customers' usage is listed as 605.9 MG, but the correct, calculated sum is 188.2 MG. This error affects that calculation on the first page of the section.

#10 Other Usage	
City of Caddo Mills	60.1
Shady Grove WSC	39.0
Jacobia WSC	32.6
Caddo Basin SUD	10.7
Presbyterian Hospital System	18.9
Greenville ISD	17.6
Americana Apartments	9.3
Reported Sum	605.9
Correct Sum	**188.2**

Error was corrected, and Water Audit Worksheet updated. Please refer to City of Greenville worksheets in Appendix C, Supplemental Tasks, of the January 5, 2006 Water Plan.

- City of Greenville: On the first page, the Water Audit Corrections are listed as 745 MG: reported sales/usage of 115.7 MG (industrial) plus 23.1 MG (power) plus 605.9 MG (other wholesale). As was noted above, the 605.9 MG reported as Other usage in the audit form should be 188.2 MG. Thus, the sum of these sales (Water Audit Corrections) should be 327 MG rather than 745 MG. The Water Audit Annual Use should be 1,372 MG rather than 954 MG, and the Water Audit Calculated Per Capita Water Use should be 157 rather than 109.

	IPP Supplemental Tasks	**Corrected Figure**
Water Audit Base Year	2000	
Water Audit Annual Water Production	1,699	
Water Audit Corrections	745	**327**
Water Audit Annual Use	954	**1,372**
Water Audit Population	23,948	
Water Audit Calculated Per Capita Water Use	109	**157**

Error was corrected, and Water Audit Summary updated. Please refer to City of Greenville worksheets in Appendix C, Supplemental Tasks, of the January 5, 2006 Water Plan.

- City of Hughes Springs section, first unnumbered page: The IPP Reported 2000 Population is cited as 1,848, but the 2000 Census, and the figure used in the IPP Chapter 2 Appendix is 1,856. The population of the city is split between Cass County (1,848) and Morris County (8).

Hughes Springs total population is 1,856 as shown in the audit table and as reported in DB07. The population is split between Region D & I as shown above.

- City of Kilgore section, first unnumbered page:

	Appendix C – Supplemental Tasks	Appendix A – Chapter 2 Appendix	TWDB Approved Figures
IPP Reported 2000 Water Use	983 MG (3,017.8 acre-feet)	n/a	775.2 MG (2,380 acre-feet)
IPP Reported 2000 Population	11,588	8,712 (plus 2,580 in Region I sums to 11,301)	11,301
IPP Calculated Per Capita Water Use	232	188	188

- Note the Kilgore Water User Group, as included in the regional water planning process, includes only the population-served and water used within the city limits, as reported by the 2000 Census. In auditing the water use of the utility, it is certainly appropriate to consider all of the population served, but this utility population should be differentiated from the Water User Group population. The water audit specifies that 310 utility customers reside outside of the City of Kilgore (third unnumbered page in section).

Populations in revised table show WUG population and CO population separately.

- City of Lindale section, first unnumbered page: The population and water use of Lindale is divided between the North East Regional Water Planning Area (Region D) and the East Texas Regional Water Planning Area (Region I). Thus, the population and water use of Lindale in both planning areas, as shown in the table below, should be considered when comparing to a water audit:

	Appendix C – Supplemental Tasks	Appendix A – Chapter 2 Appendix	TWDB Approved Figures
IPP Reported 2000 Water Use	170 MG (521.9 acre-feet)	n/a	675 acre-feet (Reg. D – 521 acre-feet; Reg. I – 154 acre-feet)
IPP Reported 2000 Population	2,281	2,281	2,954 (Reg. D – 2,281; Region I – 673)
IPP Calculated Per Capita Water Use	204	204	204

Revised table shows Region D and Region I population separately.

Level 2 Comments – Comments/Suggestions for improving the Regional Water Plan

Executive Summary

28. Page i, first paragraph: Clarify the statement that the RWPG includes "representatives of twelve key public interest groups." Revise sentence to show that there are 11 interest groups.

Revised to say "eleven interest groups".

29. Page i, last paragraph: States that the summary is an overview of the seven chapters of the regional plan. The plan consists of ten chapters.

Revised to say "ten chapters".

Chapter 1

30. Chapter 1, pages 1-26 and 1-49: Consider expanding the description of manufacturing employers due to the large role of manufacturing water use in the region.

Additional manufacturers with high water usage were listed.

Chapter 3

31. Table 3.1: A dramatic decrease in reuse availability is shown after 2010. Consider providing an explanation for this decrease in the text.

32. Table 3.6: Footnotes state that Groundwater Availability Models were used to estimate the groundwater availability reported in Table 3.6. However, TWDB GAMs are not available for the Nacatoch and Blossom aquifers. Consider providing a reference for the availability for these aquifers.

Chapter 4

Skip 33. Chapter 4: Consider including a matrix containing discounted costs for all strategies as an appendix.

34. Chapter 4, page 4-46, second paragraph: The report states that water conservation is not applicable for electric power generation. Please consider pages 145 to 157 of the *Water Conservation Best Management Practices Guide* descriptions of conservation options that might apply.

We reviewed the *Water Conservation Best Management Practices Guide* for conservation options that might apply for electric power. In this round of planning, estimates were not made for electric power water conservation because data on operating strategies for each power plant was not available.

Overall Suggestions

35. In Appendix A, consider revising Figures A1.1 through A1.49 so that the concentration ranges are identifiable on all maps.

36. Consider providing a more detailed Table of Contents at the beginning of the plan.

Detailed Table of contents is located at front of each chapter.

Region D – Initially Prepared Plan – Agency and Public Comments and Responses

Commenting Person / Entity	Date	Nature of Comment	Response / Change to IPP
Public Meetings Oral Comments	12/09/04 & 8/02/05	• Plenty of water in East Texas, do not need more lakes, use more ground water, use desalinization, treat brackish water, reuse of water, consider private property rights • Consider effects of a mitigation bank • Present all water planning issues and discuss them openly, vote by show of hands on yea & nay, involve more land owners in the planning group, protect private property rights • Against Marvin Nichols Lake • Improve oil well casing regulations and monitoring, plug the unused & abandoned oil wells, Texas Railroad Commission needs to be more sensitive • Raise the level of Wright Patman Dam and Lake, make better utilization of the water we have • Region C is taking Region D's water, Use Toledo Bend water • Cannot trust the DFW area • How can Region D afford to loose jobs • The water use in Region C is too high	Included discussion in plan. Recommended Section 8.3.6. Adopted by RPG Adopted in Section 8.3.1. Recommended by RPG in Section 8.3.5. Recommended by RPG 8.3.4 No comment. No Comment. No Comment No Comment
Public Meetings Written Comments	12/09/04 & 8/02/05	• Property Rights are a big issue, use desalinization to expand water availability • No lake on the Sulphur River • Take Marvin Nichols out of the water plan • Mitigation is too costly and too much land to loose, consider the property rights of the land owners • How will the tax base be replaced if a lake is built • A lake will destroy the bottom land hardwood and there is too much loss of productive land	Included discussion in plan Considered by RPG, No changes necessary. Discussed by RPG, Section 8.3.6 Considered by RPG, Section 8.2.5 Considered by RPG (8.2.5)

Texas Water Development Board Comments	9/28/05	Various specific comments. See attached comments and responses.	Changes made accordingly and detailed changes addressed directly to TWDB.
Texas Parks and Wildlife Department	9/30/05	• IPP does not include the quantitative reporting on environmental factors • Consider the impacts on ground water on spring flows • Supports the Region D consideration of brush control/management to benefit wildlife habitat • Disappointed that no streams designated ecologically unique	Table 7.1 "Summary of Evaluation of Water Management Strategies" Detailed analysis is beyond scope. No change necessary. No change made.
City of Longview	9/14/05	Disagrees that there is additional need for water in the upper basin of the Sabine and it should be met by the Toledo Bend pipeline and the Prairie Creek reservoir	RPG considered. No change made based on comments by SRA.
Sabine River Authority	10/25/05	Recommends the Toledo Bend Pipeline project as an Alternative Strategy	Recommended in Section 8.3.4
National Wildlife Federation, Lone Star Chapter of the Sierra Club and Environmental Defense	9/29/05	General • Questioned cost calculations and request more progress water conservation • Limit nonessential use of water during drought conditions • Environmental flows should be recognized as water demand and plans should seek to provide reasonable levels of environmental flows • Manage groundwater sustainably by adopting a long-term approach that balances pumping with recharge • Facilitate short-term transfers as a key mechanism for meeting water demands • New reservoirs should be minimized and considered only after existing sources are maximized to reasonable extent Specific • Consideration of water conservation measures applicable to manufacturing demands is critically important • Identify water conservation or drought management as	A number of comments took issue with positions that the RPG has taken on specific subjects. Other comments will be suggested for further study in the next round of planning. Included discussion in report, Sec. 8.2.5. No response necessary.

NWF / LSC SC / ED (continued)		water management strategies • How was the minimum level of 115 g/c/d established • The cost of the conservation measurers appear to be over stated by a factor of 3 • Recommendation of the Prairie Creek Reservoir development and other recommendations appear to be in conflict • Recommendation for the development of the Prairie Creek Reservoir has not been justified Chapter 1 • More discussion of the importance of bottomland hardwood forests as wildlife habitat and valuable resource for timber production • Require the identification of major springs as required • Update information on surface water quality • Group commended for the inclusion of acknowledgement of environmental water demands • Comment on the threat to natural resources by inundation of reservoirs and the associated loss of out-of-bank flows • More specific information about which aquifers have experienced water level declines • Request more specific information about wetlands in the region Chapter 2 • Question regarding how calculations were made on table 2.20 • Request the planning group to allow the effects of application of new technology to lower 2060 projected water use below 115 gpcpd for individual municipal water user groups. Chapter 3 • Request explaination for table 3.4 regarding the reduction in water supply for the Chapman/Cooper Lake/ Reservoir North Texas MWD System.	Explained in a later section of report. No response. Beyond scope of this project.

NWF / LSC SC / ED (continued)		• Setting supply equal to demand for groundwater pumping would not be considered conservative for some areas of the region where water level declines have already been experienced. • Requested additional aquifer drawdown information for areas of greater than 50' or greater than 10% of saturated thickness drawdown. • Requested planning group to reconsider planned-depletion of the aquifer levels on the basis that it is not consistent with the long-term protection of the states water resources, natural resources and agricultural resources. Chapter 4 • Request the planning group to specifically identify one or two specific potential groundwater sources for each WUG rather than allowing future determination of groundwater supply aquifer source. • Liked the Table 4.41 & 4.32 Water Management Strategy summary table. Requested addition of a summary footnote with more information about recommended strategies addressing the larger water needs. • Requested planning group to acknowledge potential impacts on springs, seeps and associated natural resources as a result of groundwater pumping. • Requested additional discussion for Red River Redevlopment Authority and the status of water rights for Caney Creek Lake and Elliot Creek Lake. • Request discussion of the evaluation of how the decision was made to select additional groundwater development as the recommended strategy over water conservation. • Various specific comments for individual water user groups in Chapter 4. Chapter 5 • Requested discussion of decision to allow 'overdrafting' of aquifers. • Requested discussion regarding increase in diversions	

NWF / LSC SC / ED (continued)		from Lake O' the Pines to equal over 26% of the permitted yield. Chapter 6 • Requested inclusion of water management strategies for manufacturing and steam electric water users with shortages. • Drought management strategies should be included for each water user group to which Texas Water Code Section 11.1272 applies. • Entities within the region with high per capita water use should be prompted to implement water conservation programs. • The plan fails to acknowledge the decision to not account for savings from implementation of the plumbing code requirements when the effect would be to drop gpcd rates below 115 even in 2060. Requested planning group to revisit that decision. • The calculated unit costs for advanced water conservation appear to be in error and overstated by a factor of 3. • Requested the planning group to consider a high water conservation goal. Suggested particular wording as used in Region L plan. Chapter 7 • SB2 requires water plan to be consistent with the long term protection of the state's water resources, agricultural resources and natural resources. • Concerned that the proposed ground water management declines that are being permitted by the region would result in adverse impacts to springs, seeps and to surface water supplies. • Feel that planning for groundwater level declines is not sustainable for the long term. Believe that further analysis is needed to demonstrate consistency with long-term resource protection of the states water resources. • Need further discussion and analysis of how the plan is consistent with protection of agricultural natural	

NWF / LSC SC / ED (continued)		resources. • Additional discussion should be included about the impacts of groundwater pumping on springs, seeps, and surface streams. In addition effects on surface flows if Prairie Creek reservoir were developed should be discussed. Information in the plan is not adequate to support finding of long-term resource protection. • Section 7.6 is a good example of the type of information needed to assess consistency of water management strategies with long-term protection. Chapter 8 • Disappointed that the planning group has chosen not to recommend the designation of any ecologically unique stream segments. • Support decision of the planning group to not recommend designation of unique reservoir sites. • The endorsement of the development of Prairie Creek Reservoir is at odds with the basic concepts adopted by the planning group regarding reservoir construction. Need more analysis of Prairie Creek.	
Tyron Road Special Utility District	8/17/05	Proposed water supply strategies for WUG.	Adopted by Region D.
City of Wake Village, Texas	9/23/05	Requested that Marvin Nichols Reservoir be included in the Region D Water Plan so that additional studies could be performed and an informed decision made on the issue of the lake.	No change made. Refer to Section 8.3.1.
Lamar Electric Cooperative	8/19/05	Presented facts on impact of proposed Marvin Nichols I and Parkhouse I & II Reservoirs. Stated their opinion that these reservoirs would have a detrimental effect on the members, customers and employees of LEC.	No change made. Refer to Section 8.3.1
M. Lynn Chapman	7/22/05 & 2/12/02	Recommended study to benefits of combining Parkhouse I & II as one reservoir. Expressed opposition to Marvin Nichols Reservoir.	No change made. Beyond scope of project.
Dan M. Cotton & Mary K. Cotton Hazel Kelty Patricia McKelvy	8/1/05 8/25/05 8/4/05	Written request to remove Marvin Nichols and all other lakes from Region D plan.	No change necessary. Refer to Section 8.3.1

Petitions signed by approx. 1,029 people. (not checked for duplicity or accuracy)		Petitions expressing opposition to Marvin Nichols Reservoir and George Parkhouse I & II..	No change necessary. Refer to Section 8.3.1
Petition signed by 15 people	2005	Support continued studies of Marvin Nichols Reservoir.	No change made.
Red River County Resolution	4/25/05	Support further studies on Marvin Nichols I Reservoir and listed what the study should include. Neither for nor against construction of the reservoir.	No change necessary. Refer to Section 8.3.1
Delta County Commissioners Court Resolution	4/11/05	Oppose construction of any new reservoirs on the North and South Sulphur Rivers due to the negative impacts as a result of the reservoir and accompanying mitigation. Request that entities seeking water explore other viable alternatives.	No change necessary. Refer to Section 8.3.1
City of Clarksville Resolution	9/17/02	Request that Marvin Nichols Reservoir remain in Region D plan and State Water Plan until adequate studies can be conducted to determine the total impact of the reservoir on the City of Clarksville and North Texas. Support any and all studies conducted on Marvin Nichols Reservoir so that citizens will have the facts on which rational opinions may be formed.	No change necessary. Refer to Section 8.3.1
Hopkins County		Consider a plan to distribute water through the North East Texas Region by using all of the lakes together.	No change made. Beyond scope of this project.
Fran Clements	6/30/04	Request Marvin Nichols deletion from the Regional Water Plan.	No change made.
City of Clarksville	5/30/05	Request to consider adding particular language to indicate that the City of Clarksville intends to acquire groundwater in Gregg and Upshur Counties from the Carrizo-Wilcox and Queen City aquifers.	Amended 2001 plan to reflect change.
City of Annona Resolution	9/13/05	Continues to support the Marvin Nichols Reservoir, continues to support future studies in an effort to form educated and rational decisions and continue to recognize and acknowledge the economic, recreational and water benefits from building a reservoir such as Marvin Nichols.	No change necessary. Refer to Section 8.3.1
City Council of Atlanta, Texas Resolution	6/20/05	Supports North East Texas Regional Water Planning Group's Initially Prepared Plan stating that Marvin Nichols Reservoir should not be included as a water management strategy in any regional water plan or the State Water Plan. Further expresses opposition to the reservoir and extensive mitigation that would have adverse economic impacts on Atlanta, Texas. Request Marvin Nichols removed from further consideration.	No change necessary. Refer to Section 8.3.1

City of Clarksville Resolution	7/19/05	Continues to support the Marvin Nichols Reservoir, continues to support future studies in an effort to form educated and rational decisions and continue to recognize and acknowledge the economic, recreational and water benefits from building a reservoir such as Marvin Nichols.	No change necessary. Refer to Section 8.3.1
Clarksville Economic Development Corporation Resolution	9/13/05	Continues to support the Marvin Nichols Reservoir, continues to support future studies in an effort to form educated and rational decisions and continue to recognize and acknowledge the economic, recreational and water benefits from building a reservoir such as Marvin Nichols.	No change necessary. Refer to Section 8.3.1
Franklin County Resolution	10/15/02	Requested that Region D and TWDB keep Marvin Nichols Reservoir in the Region D plan until adequate studies can be conducted to factually determine the total impact of the reservoir on Franklin County and North East Texas.	No change made. Refer to Section 8.3.1
Franklin County Resolution	5/9/2005	Requested that Region D and TWDB keep Marvin Nichols Reservoir in the Region D plan until adequate studies can be conducted to factually determine the total impact of the reservoir on Franklin County and North East Texas.	No change made. Refer to Section 8.3.1
Franklin County Water District Resolution	9/20/05	Supports Marvin Nichols Reservoir, supports studies related to development of the reservoir, recognizes the water supply and economic benefits the Franklin County will reap from the development of a reservoir. Request that the regional water planning group keep the proposed Marvin Nichols Reservoir in the Region D Plan.	No change made. Refer to Section 8.3.1
City of New Boston	9/20/05	Marvin Nichols Reservoir should be included in the Region D Plan so that a basin study can be performed and information may be obtained and an informed decision made.	No change made. Refer to Section 8.3.1
Red River County Water Control and Improvement District Resolution	8/31/05	Support for Marvin Nichols Reservoir, supports future studies in an effort to form educated and rational decisions and recognizes the economic, recreational and water benefits. Requests that Region D Planning Group and TWDB include Marvin Nichols Reservoir in the Region D Plan.	No change made. Refer to Section 8.3.1

Appendix C - Table of Contents

High Per Capita Water Use Differences

Introduction

The North East Texas Regional Water Planning Group (NETRWPG) is concerned about the large difference in reported per capita uses for municipal entities within the Region and proposed to further investigate the usage data reported by the entities with high per capita demands.

Some entities exhibited high per capita use data when compared to other similar entities within the Region in the 2001 Regional Water Plan. At that time the high per capita use was assumed to be an anomaly related to data collection. However, this assumption no longer appears to be valid, because a similar number of high usages were reported for the 2006 Regional Water plan as well.

Background

For the currently approved municipal water demands, the average entity in NETRWPG area had a daily per capita demand of 133 gallons, with a standard deviation of 42. However, 23 entities reported daily per capita demands greater than 175, with 175 being the average plus one standard deviation. Reported daily per capita demands ranged as high as 285 gallons.

There are a variety of possible explanations for this spread in per capita usage. Median household income may affect water usage. Rural residents on septic tanks may use more conservatively because of disposal limitations. The percentage of "unaccounted for" water varies widely among the entities.

Some communities have a substantial commercial usage, while others do not. Likewise, some communities have a substantial institutional component that may not be accurately reflected in the census data. Additionally, when reporting manufacturing use, some entities tend to break out only their major industries, while an appreciable amount of water may be consumed by smaller industry, and some entities may have failed to break out wholesale users.

Study Approach

This supplemental task identified entities with high per capita usage systems, provided an audit of their customer lists and more accurately categorizes usage into residential, commercial, and manufacturing components. Unaccounted for water was analyzed in an effort to ensure that it is reported in a common manner. Through interviews with appropriate system staff, the NETRWPG has identified anomalies that would affect per capita usage calculations.

Specific tasks included:

- Developed interview materials / Regional Water Audit Worksheet to ensure consistency.
- Selected water user groups to be surveyed.
- Conducted in person interviews with each selected entity.
- Reviewed customer account records for the purpose of quantifying commercial, multifamily, residential and manufacturing uses.
- Compiled median household income data.

Water user groups selected for survey and a summary of findings are shown on Table 1.0: High Per Capita Water Use Study Results on the following page. The Water Audit Worksheets and additional data are compiled for each entity in the remainder of the chapter.

Table 1.0: High Per Capita Water Use Study Results

Entity	Water Use (Before Survey)	Adjusted Water Use	Potential Explanation of High Water Use *
City of Canton	238 gpcpd	230 gpcpd	City of Canton has a flea market that attracts approximately 1 million visitors annually. Water usage at the market is not metered.
City of Como	410 gpcpd	111 gpcpd	Actual water usage was much less than water produced. Also, manufacturing and livestock usage were included in initial estimate.
City of Greenville	207 gpcpd	157 gpcpd	Water use for manufacturing and power generation were not initially separated out.
City of Hughes Springs	212 gpcpd	154 gpcpd	High unaccounted for water.
City of Kilgore	232 gpcpd	170 gpcpd	City does not track manufacturing water use separately from residential water use.
City of Lindale	204 gpcpd	204 gpcpd	No apparent anomaly.
City of Mineola	189 gpcpd	132 gpcpd	High water loss during audit base year has been corrected.
City of New Boston	198 gpcpd	127 gpcpd	City of New Boston supplies water to a prison. Population of inmates had not been included in population estimates used for per capita use.
Liberty City WSC	188 gpcpd	118 gpcpd	Population projected in plan compared to actual water connections was abnormally low.
New Hope WSC	184 gpcpd	138 gpcpd	Population projected in plan compared to actual water connections was abnormally low.
Shady Grove WSC	199 gpcpd	66 gpcpd	Has livestock supplies and supplies water to RV Park and Pleasant Hill WSC.

* Please see following pages for a more detailed explanation of per capita water use changes.

Summary of Results

Entities exhibiting high per capita water use were generally found to have a reasonable explanation based in their water accounting system. Once the appropriate adjustments were made the per capita water use was within the region wide average plus one standard deviation (175 gpcpd). Common explanations included:

- Manufacturing and other water uses were included in the municipal water calculation.
- Population projections for the entity were low when compared to the actual number of connections served or actual number of persons served.
- High amounts of unaccounted for water.

The City of Canton, however is a special situation in which per capita water usage is skewed by the large number of non-residents visiting the city on a monthly basis. The City of Canton's water use of 238 gpcpd, before water audit, was slightly higher than the adjusted water use of 230 gpcpd. Further analysis of City of Canton's water usage and water loss in the existing distribution system may reveal the reason why the city has a water usage that is much higher than the 140 gpcpd set by the regional water planning group.

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City of Canton
Water Audit Summary

IPP Reported 2000 Water Use	286	MG
IPP Reported 2000 Population	3292	Persons
IPP Calculated Per Capita Water Use	238	gpcpd
Water Audit Base Year	2000	
Water Audit Annual Water Production	330	MG
Water Audit Corrections	0.91	MG
Water Audit Annual Use	329	MG
Water Audit Population	3915	Persons
Water Audit Calculated Per Capita Water Use	230	gpcpd

Explanation of water audit results:

The City of Canton had a reported water use of 238 gpcpd in the Initially Prepared Plan (IPP) for the 2006 North East Texas Regional Water Plan. After performing a water audit based on information provided by the City of Canton it was determined that the calculated per capita water use was actually 230 gpcpd. Further review and study during the water audit revealed that the City of Canton has a 0.91 MG water usage for customers that use over 250,000 gallons per year. Deducting this amount, results in an actual water use of approximately 329 MG/yr or 230 gpcpd, which is higher than the 140 gpcpd threshold set by the water planning group.

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City of Como
Water Audit Summary

IPP Reported 2000 Water Use	139	MG
IPP Reported 2000 Population	932	Persons
IPP Calculated Per Capita Water Use	410	gpcpd
Water Audit Base Year	2000	
Water Audit Annual Water Production	20.43	MG
Water Audit Corrections	0.87	MG
Water Audit Annual Use	19.56	MG
Water Audit Population	679	Persons
Water Audit Calculated Per Capita Water Use	79	gpcpd

Explanation of water audit results:

The City of Como had a reported water use of 410 gpcpd in the Initially Prepared Plan (IPP) for the 2006 North East Texas Regional Water Plan. The earliest complete record of water usage available from the city was from the reporting period of April 2004 to March 2005. After performing a water audit based on information provided by the City of Como it was determined that the calculated per capita water use was actually 79 gpcpd. Further review and study during the water audit revealed that the City of Como had a 20.43 MG total water usage – which was much lower than the total production of 0.382 MGD (139.43 MG) reported by the city to the TCEQ. Industrial/manufacturing, livestock and Como-Pickton Schools usage account for only 0.87 MG. Deducting 0.87 MG from the total city usage of 20.43 MG and dividing by audited population of 679 persons, the resulting per capita water use is 79 gpcpd - which is lower than the 140 gpcpd set by the regional water planning group.

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City of Greenville
Water Audit Summary

IPP Reported 2000 Water Use	1810	MG
IPP Reported 2000 Population	23960	Persons
IPP Calculated Per Capita Water Use	207	gpcpd
Water Audit Base Year	2000	
Water Audit Annual Water Production	1699	MG
Water Audit Corrections	327	MG
Water Audit Annual Use	1372	MG
Water Audit Population	23948	Persons
Water Audit Calculated Per Capita Water Use	157	gpcpd

Explanation of water audit results:

The City of Greenville had a reported water use of 207 gpcpd in the Initially Prepared Plan (IPP) for the 2006 North East Texas Regional Water Plan. After performing a water audit based on information provided by the City of Greenville, it was determined that the calculated per capita water use was actually 157 gpcpd. Further review and study during the water audit revealed that the City of Greenville has a 327 MG water usage for industrial/manufacturing, power generation and customers that uses over 250,000 gallons per year. Deducting this amount, results in an actual water use of approximately 1372 MG/yr or 157 gpcpd, which is higher than the 140 gpcpd threshold set by the water planning group.

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City of Hughes Springs
Water Audit Summary

IPP Reported 2000 Water Use	143	MG
IPP Reported 2000 Population	1848	Persons
IPP Calculated Per Capita Water Use	212	gpcpd
Water Audit Base Year	2000	
Water Audit Annual Water Production	168	MG
Water Audit Corrections	23	MG
Water Audit Annual Use	145	MG
Water Audit Population	1848	Persons
Water Audit Calculated Per Capita Water Use	216	gpcpd

Explanation of water audit results:

The City of Hughes Springs had a reported water use of 212 gpcpd in the Initially Prepared Plan (IPP) for the 2006 North East Texas Regional Water Plan. After performing a water audit based on information provided by the City of Hughes Springs it was determined that the calculated per capita water use was actually 216 gpcpd. Further review and study during the water audit revealed that the City of Hughes Springs has unaccounted for water in the amount of 41.6 MG/yr. Deducting this amount, results in an actual water use of approximately 103.4 MG/yr or 154 gpcpd. This amount would be considered above average for the Region but within an acceptable range. For planning purposes, the City of Hughes Springs must continue to plan for the higher use rate until such time as the unaccounted for water use can be reduced.

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City of Kilgore
Water Audit Summary

IPP Reported 2000 Water Use	983	MG
IPP Reported 2000 Population		
City WUG	11301	Persons
County Other	287	Persons
Total	11588	Persons
IPP Calculated Per Capita Water Use	232	gpcpd
Water Audit Base Year	2000	
Water Audit Annual Water Production	1093	MG
Water Audit Corrections	127	MG
Water Audit Annual Use	966	MG
Water Audit Population	11588	Persons
Water Audit Calculated Per Capita Water Use	228	gpcpd

Explanation of water audit results:

The City of Kilgore had a reported water use of 232 gpcpd in the Initially Prepared Plan (IPP) for the 2006 North East Texas Regional Water Plan. After performing a water audit based on information provided by the City of Kilgore it was determined that the calculated per capita water use was actually 228 gpcpd. Further review and study during the water audit revealed that the City of Kilgore does not track manufacturing water use separately from residential water use. Municipal water for the Gregg County area typically accounts for 80 percent of the total amount of water used. If this proportion is correct for the City of Kilgore, the actual use is approximately 182 gpcpd. This amount would be considered above average for the Region but within an acceptable range. For planning purposes, the City of Kilgore must continue to plan for the higher use rate until such time as the industrial and manufacturing water can be accurately determined.

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City of Lindale
Water Audit Summary

IPP Reported 2000 Water Use	220	MG
IPP Reported 2000 Population		
Region D	2281	Persons
Region I	673	Persons
Total	2954	Persons
IPP Calculated Per Capita Water Use	204	gpcpd
Water Audit Base Year	2004	
Water Audit Annual Water Production	217	MG
Water Audit Corrections	0	MG
Water Audit Annual Use	217	MG
Water Audit Population	2954	Persons
Water Audit Calculated Per Capita Water Use	201	gpcpd

Explanation of water audit results:

The City of Lindale had a reported water use of 204 gpcpd in the Initially Prepared Plan (IPP) for the 2006 North East Texas Regional Water Plan. After performing a water audit based on information provided by the City of Lindale, it was determined that the calculated per capita water use for 2004 was 201 gpcpd. The year 2004 was used because the City did not have easy access to data from the year 2000. Further review and study during the water audit did not reveal any problems which would explain why the water use is higher than the average for the region. The City of Lindale indicated they do not have any industrial users. Previously they had sold water to local nurseries and two rural water suppliers but no water was sold in the year of study for 2004. The City did report a higher population in 2004 than the 2000 census listed, but they also had a proportionate increase in water use from 2000 to 2004. Based on this additional study the City of Lindale should continue to plan for the higher water use and encourage water conservation from their customers.

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City of Mineola
Water Audit Summary

IPP Reported 2000 Water Use	306	MG
IPP Reported 2000 Population	4550	Persons
IPP Calculated Per Capita Water Use	184	gpcpd
Water Audit Base Year	2000	
Water Audit Annual Water Production	315	MG
Water Audit Corrections	2.5	MG
Water Audit Annual Use	312.5	MG
Water Audit Population	5515	Persons
Water Audit Calculated Per Capita Water Use	155	gpcpd

Explanation of water audit results:

The City of Mineola had a reported water use of 189 gpcpd in the Initially Prepared Plan (IPP) for the 2006 North East Texas Regional Water Plan. After performing a water audit based on information provided by the City of Mineola, it was determined that the calculated per capita water use for 2000 was 155 gpcpd. Further review and study during the water audit revealed that the City of Mineola had a high water loss rate during the audit base year. The City has corrected many of the problems causing the high loss rate and they believe they have lowered the rate from 25 percent to approximately 15 percent. Assuming a loss rate of 15 percent would lower the per capita use to 132 gpcpd which is within the range of average use for the region.

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City of New Boston
Water Audit Summary

IPP Reported 2001 Water Use	384	MG
IPP Reported 2001 Population	5305	Persons
IPP Calculated Per Capita Water Use	198	gpcpd
Water Audit Base Year	2001	
Water Audit Annual Water Production	385	MG
Water Audit Corrections	0	MG
Water Audit Annual Use	385	MG
Water Audit Population	8301	Persons
Water Audit Calculated Per Capita Water Use	127	gpcpd

Explanation of water audit results:

The City of New Boston had a reported water use of 198 gpcpd in the Initially Prepared Plan (IPP) for the 2006 North East Texas Regional Water Plan. After performing a water audit based on information provided by the City, it was determined that the calculated per capita water use was actually 127 gpcpd. The earliest record available for auditing was the 2001 record. The City of New Boston has one prison, Barry Telford Unit – Texas Department of Criminal Justice, that houses approximately 3000 inmates. This inmate population was not included in the 2001 city population - hence the higher per capita water usage. In 2001, the population inside the city limits plus the prison population was 8301 persons. Dividing the annual water usage of 385 MG by the total population served, the per capita water use is therefore 127 gpcpd, which is less than the 140 gpcpd threshold set by the water planning group.

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Liberty City WSC
Water Audit Summary

IPP Reported 2000 Water Use	180	MG
IPP Reported 2000 Population	2614	Persons
IPP Calculated Per Capita Water Use	188	gpcpd
Water Audit Base Year	2000	
Water Audit Annual Water Production	180	MG
Water Audit Corrections	10.7	MG
Water Audit Annual Use	168.9	MG
Water Audit Population	3908	Persons
Water Audit Calculated Per Capita Water Use	118	gpcpd

Explanation of water audit results:

The Liberty City WSC had a reported water use of 188 gpcpd in the Initially Prepared Plan (IPP) for the 2006 North East Texas Regional Water Plan. After performing a water audit based on information provided by the Liberty City WSC, it was determined that the calculated per capita water use for 2000 was 118 gpcpd. Further review and study during the water audit revealed that LC WSC had a population component which was abnormally low based on connection data. The total water demand is not significantly impacted by this error, since the higher per capita use was used to multiply times the lower population base. Based on this additional study the Liberty City per capita use is within the range of average use for the region.

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New Hope WSC
Water Audit Summary

IPP Reported 2000 Water Use	90	MG
IPP Reported 2000 Population	1336	Persons
IPP Calculated Per Capita Water Use	184	gpcpd
Water Audit Base Year	2000	
Water Audit Annual Water Production	92	MG
Water Audit Corrections	1.8	MG
Water Audit Annual Use	90	MG
Water Audit Population	1788	Persons
Water Audit Calculated Per Capita Water Use	138	gpcpd

Explanation of water audit results:

The New Hope WSC had a reported water use of 184 gpcpd in the Initially Prepared Plan (IPP) for the 2006 North East Texas Regional Water Plan. After performing a water audit based on information provided by the New Hope WSC, it was determined that the calculated per capita water use for 2000 was 138 gpcpd. Further review and study during the water audit revealed that NH WSC had a population component which was abnormally low based on connection data. The total water demand is not significantly impacted by this error, since the higher per capita use was used to multiply times the lower population base. Based on this additional study the New Hope per capita use is within the range of average use for the region.

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Shady Grove WSC #2
Water Audit Summary

IPP Reported 2000 Water Use	33	MG
IPP Reported 2000 Population	450	Persons
IPP Calculated Per Capita Water Use	199	gpcpd
Water Audit Base Year	2000	
Water Audit Annual Water Production	31.3	MG
Water Audit Corrections	21.4	MG
Water Audit Annual Use	9.9	MG
Water Audit Population	413	Persons
Water Audit Calculated Per Capita Water Use	66	gpcpd

Explanation of water audit results:

Shady Grove WSC #2 had a reported per capita water use of 199 gpcpd in the Initially Prepared Plan (IPP) for the 2006 North East Texas Regional Water Plan. A water audit was done based on information provided by the WSC and a total annual 2000 water usage estimated as 31.3 MG. The audit showed that Shady Grove has livestock usage, mostly dairy, and also supplies water to Shady Lake RV Park and Pleasant Hill WSC. The total amount of water supplied to livestock, RV Park and Pleasant Hill WSC is 21.4 MG. Subtracting 21.4 MG from the Water Audit Annual Use of 31.3 MG, results in a residential water usage of 9.9 MG. The residential per capita water use is therefore 66 gpcpd, which is less than the 140 gpcpd threshold set by the water planning group.

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I. Introduction

In February 2004 the North East Texas Regional Water Planning Group (NETRWPG) requested of the Texas Water Development Board (TWDB) that they be allowed to study the effect of combining identified clusters of small public supply systems into sub-regional water supply systems. In 2005 the TWDB approved the supplemental request and the NETRWPG authorized the preparation of the study.

A total of 51 existing public water supply systems were selected for inclusion in the study and they were combined geographically into 10 logical clusters. These clusters are in six of the most southerly counties in the northeast Texas region. They are Hopkins County, Rains County, Van Zandt County, Harrison County, Upshur County and Smith County. The other counties were omitted as they had previously utilized regionalization or the existing systems were already of sufficient size and additional combination was of limited benefit. The final clusters vary in size from 1252 connections to 4167 connections with the goal being to have approximately 2000 connections. A total of 25,544 connections were included.

The 51 systems selected for study vary in size from 30 connections to 2300 connections. The 51 selected supply systems were combined into the 10 clusters varying from three to seven in the final selections. The final clusters are reported on as to advantages and disadvantages herein.

II. Changed Conditions

Since the beginning of the preparation of the 2006 State Plan by the Regional Water Planning Groups there have been changed conditions which increase the need for regionalization. Some of these changed conditions include:

- The Texas Legislature enacted legislation exempting regional water supplies from the state sales tax. This provides an automatic 6% to 8% savings on capital investments, freeing up these funds for improved quality or quantity of supply.

- The United State Environmental Protection Agency (USEPA) and TCEQ are proposing a significant series of rule changes that will have a dramatic negative impact on smaller water user groups. These include the LT2ESWTR and Stage 2 DBPR rules (proposed effective 2004), Groundwater Rules (2005), Radon Rules (2007), and Arsenic Rules (2006). These rules will not only impact water costs, but in many cases will exceed the technical and managerial capabilities of the water user group. In Region D 53% (135 of 255) of water user groups serve less than 500 connections.

- Land development appears to be accelerating significantly in areas adjacent to the metroplex. While these will not likely affect overall regional projections, small systems in specific areas may be overwhelmed. For example, a land development of up to 2400 homes has received preliminary plat approval in eastern Hunt County.

- The public is becoming increasingly aware of the benefits of regional water supplies, as evidenced by projects such as the Northeast Texas Municipal Water District's South Side Regional Water Treatment Plant. 12 smaller entities participated in the planning for this project. This task would identify clusters of water systems which have a strong potential for uniting – the identified projects could then be submitted by the entities for more detailed planning under the Texas Water Development Board Regional Water Planning program.

It has been a consideration that many of the smaller existing public water systems may lack the technical, financial and managerial capacity to remain viable as separate entities over the long term. The purpose of the study was be to identify and evaluate discrete projects to consolidate one or more small water systems or to inter-connect one or more of these small systems to a major water provider.

III. Scope of Services

The NETRWPG reviewed the public water supply systems in the region and selected 50 public water supply systems that might fit the criteria. These were combined into 10 clusters and identified for study. The NETRWPG then adopted the following Scope of Services to be completed in the study of these clusters:

A. The Regional Water Planning Group will establish a system size for inclusion in the study. Tentatively it is suggested that systems of less than 750 connections would be considered.

B. Identify potential candidates based on surveys accomplished during the basic planning process.

C. Identified systems would be indicated on a regional map.

D. Review bibliography developed in the 2002 plan, and TWDB publications, to avoid duplication of effort, particularly in the Sabine basin.

E. Review and evaluate information from TCEQ/TRWA regarding the financial managerial and technical capabilities of each system, where available.

F. Identify clusters of systems, which appear viable for further study, compile the information gathered above and report to the Regional Water Planning Group as necessary.

G. The Regional Water Planning Group will establish a financial commitment for water supply which appears reasonable for the county or sub-area in question. Initially, 1 % of median household income is suggested, subject to further evaluation by the Regional Water Planning Group.

H. Evaluate supply facilities existing within the individual systems and additional groundwater or surface water supplies or transmission mains, which would be necessary to consolidate the system. The evaluation would be limited to supply facilities only, and would not include facilities specific to the distribution systems.

I. Prepare a summary discussion of financing alternatives and institutional mechanisms available for regionalization.

J. Prepare a summary discussion of common legal, financial, and institutional barriers to consolidation.

K. Prepare a summary discussion of existing and proposed regulations which will impact the financial, managerial, and technical abilities of smaller systems to exist as discrete entities.

L. Consult with the entities where studies show a cost effective possibility for consolidation to discuss the political realities of consolidation.

M. Compile the above data into a report for presentation to the Regional Water Planning Group and meet with the Regional Water Planning Group as necessary to receive input and approvals. This scope of work will be included in Task 4.

IV. Financial Managerial and Technical Capabilities

Financial, managerial, and technical capabilities (FMT) refer to the ability of a system to:

- Obtain adequate financing at reasonable rates in order to construct capital improvements in a timely manner and to fund adequate operation and maintenance.

- Manage its day-to-day operations in an efficient manner, including business planning, legal issues, financial issues, regulatory requirements and human resource management. Managerial issues extend not only to the staff, but also to the governing body.

- Operate the system in a safe, efficient, economical manner, with particular attention to the quality of the water delivered and adherence to regulatory requirements.

In effect, FMT refers to the ability of a system to sustain its core purpose of operating in a safe, reliable, compliant and fiscally appropriate manner. A system must have the proper levels of FMT resources to sustain itself over the long term. Recognizing this, TCEQ assumes that a proper level of FMT exists in the systems for which it issues permits, and TWDB requires an assessment of FMT prior to awarding funding to systems.

Although small water systems serving fewer than 3,300 customers comprise less than 20% of the national population served by community water systems, these same systems account for much of the attention of rural water regulators because of the water system’s inability to consistently comply with state and federal regulations. The small size of these systems makes it difficult for them to have the FMT capabilities of larger, more compliant systems. An example of this is found in the statistics pertaining to regulatory violations per 1,000 persons served: systems serving 25 to 500 persons have the most violations of all size categories.

Small water systems also tend to provide water at a higher unit cost, due to inefficient economies of scale. In utilities in general, unit costs of production decline as the number of units produced increases. Capital investment, materials purchasing, personnel costs, and the burden of billing, purchasing, and general administration become less as unit volume increases. This reduction in unit cost was measured as 0.16% for every 1% increase in production in a recent national study on the benefits of consolidating rural water systems.

FMT resources are scarce among small, isolated rural water systems. The economic capability of the service area is constrained by the small population which must invest in new capital equipment and meet new regulatory and operating requirements. In addition, many small, rural systems serve a population that includes a disproportionate number of households earning less than the State median household income. It is difficult for these small systems to obtain sufficient capital for new equipment and to meet new regulatory requirements, and still have a monthly household water bill that is affordable.

As a general rule, FMT capabilities improve as the size of a system increases. This is because a larger customer base provides more income to support management functions and adequate staffing. One way of increasing the effective size of a system is through consolidation. This can involve either the actual physical interconnection of two or more water systems, and the assumption of administrative and management functions by a single board, or simply consolidating purchasing and other administrative functions among several separate systems. For purposes of this study, consolidation is considered to be the merging of two or more systems into a single entity. Consolidation of several systems can provide the necessary economies of scale for adequate FMT and long term sustainability. Some of the smaller systems studied herein for consolidation have no full-time staff maintenance. Billing and other functions are performed by a part-time employee, or by volunteers. The ability of these small systems to sustain themselves in an era of increasing complexity and cost of providing adequate quantities of safe in a compliant and fiscally sound manner is in doubt.

There are a great number of benefits to water systems and their customers from consolidation. Examples of FMT improvements likely to occur as a result of consolidation include:

- Access to private financing will improve. Private lenders will look more favorably upon a system with proper management and operating strategies in place. Many private lenders require an independent audit of system finances before considering a loan, and many very small systems do not have annual audits because of the high cost relative to their small size.

- The price of water should be more stable. Very small systems often postpone routine and preventative maintenance, and, as a consequence, the system develops major needs. When the cost of addressing these needs is spread over a very small customer base, the cost of water increases dramatically. Although an annual maintenance and capital investment program would reduce these costs over time, such programs require ongoing master planning, which small systems frequently avoid because of the cost.

- Capital expenditures should be more efficient. For example, one new well may produce adequate water for the consolidated system, whereas multiple wells would otherwise be drilled to meet the needs of the individual entities. This economy of scale may be duplicated in a number of areas, such as storage, pressure and transmission facilities.

- A larger customer base provides additional income for full-time personnel. For example, a $20,000.00 per year salary spread over 200 customers is $8.33 per customer per month. Spread over 2000 customers, it is only $0.83 per customer per month. Initial personnel could include a full-time operator, assistant operator, and office person, with an administrator or manager added as growth permits. A secondary advantage of having an operator and assistant operator involves personnel turnover. When one operator or the other leaves the system for employment elsewhere, the remaining operator is on hand to continue operating the facility while a second, replacement operator is hired. Contrast this to small, one operator systems. When that lone operator leaves, the system is left to manage with largely untrained board members or other unlicensed personnel until a replacement can be found, which sometimes takes months. During this period, the potential safety of the drinking water supply is threatened due to a lack of properly trained personnel.

- Operating costs may be reduced in the consolidated system. Costs of insurance, materials, supplies, and other necessities may be lower due to the greater negotiating power of a larger system. Additionally, consolidation may provide the impetus to organize the new entity as a district. Many small systems are non-profit corporations, which must pay sales tax on purchases. A district, on the other hand, is a sales tax exempt entity, and thus saves this expense.

- Personnel can be more adequately trained since they are full-time, and because extra income is available for training. This should also reduce costs, since better trained personnel should be able to operate and maintain the capital investment in a more cost effective manner.

- The consolidated system is more likely to comply with regulatory requirements, since the personnel can be trained in these requirements and a broader customer base is available to share the costs of operations, maintenance and capital outlay. This is borne out statistically, since larger systems have fewer violations per 1,000 persons than smaller systems.

- The quality of water produced should improve, since personnel are properly trained and income exists for necessary process control and regular maintenance.

- The quality of management can improve, since there is a larger pool of candidates from which to choose the governing body.

- Master planning of long term system needs is more likely to be started and maintained, because there are more resources available for this purpose. A key difference between systems with adequate FMT and those without is an ongoing capital maintenance and improvements program, which extends the useful life of facilities, and lowers their long term cost.

- Finally, without consolidation, the continued viability of the smaller systems is in question. Many of the volunteers running these systems do so because they remember the times before public water was available and recognize the critical need. Lifestyle changes, and the fact that public water is now taken for granted, result in fewer and fewer people willing to volunteer. Likewise, ever increasing regulatory and technical issues require more and more time.

In summary, the consolidation of smaller systems into larger entities will result in improved financial, managerial and technical capabilities.

V. Legal, Financial and Institutional Barriers

Various legal, financial, and institutional barriers can affect consolidations. As a general rule, these barriers can be overcome if the consolidating parties are interested in a successful outcome.

Water-providing entities can be cities, municipal utility districts, special utility districts, not-for-profit corporations, investor owned corporations, and river or other special authorities. Each of these operates under its own laws with respect to selection of its governing body, meeting conduct, financing capabilities, bidding and contracting, and a host of other areas. Selection of the best consolidation format should be based upon the particular circumstance of each merger.

There are many practical barriers to consolidation which are outlined below. However, a primary obstacle to consolidation in some instances is the loss of local control, and a fear of what that might mean. Many small water corporations are the only core institution serving their particular area, and surrendering that identity is sometimes politically difficult. Joining a larger group reduces the smaller community's ability to direct their future. Unless the advantages of consolidation are carefully presented, and clearly obvious, the fear of loss of local control may be enough to prevent consolidation.

Consolidation also means job loss for some of the administrative employees of the merging districts. The consolidated district will only need one billing and collecting clerk, one secretary, one manager, and so forth. Resistance to the consolidation can be encountered from those who fear loss of their job.

Another barrier can be perceived costs and benefits. Some systems may bear a disproportionate share of costs relative to benefits derived when compared to the other systems with whom they might consolidate.

A financial barrier that often exists is the difference in financial condition between the various entities. If one system is in good financial shape, it may not be willing to take on the burden of a system in poor condition or deeply in debt. Often the parties seek grants and/or low interest loans to ease this reluctance, and government agencies such as the TWDB and the United States Department of Agriculture (USDA) have programs that encourage consolidation with financial incentives.

Likewise, rate differences may be an issue. A system which has made little or no improvements over the years may have an artificially low rate. Ultimately, however, major improvements will have to be made, and the rate will spike. Until that happens, there is little financial incentive to merge with a system with higher rates.

Outstanding debt can be a barrier to consolidation. Cities, districts and certain other entities issue bonds to provide capital for system improvements. These bonds may contain covenants which prohibit sale or disposal of all or parts of the system until the bonds are paid off. Corporations generally finance improvements by mortgaging their physical assets. Some financial institutions may be unwilling to take a junior lien debt.

As a general rule, governmental entities cannot issue debt for facilities that they will not own. Thus if two or more governmental entities wish to consolidate their water supplies, special steps must be taken. Generally either one city takes the lead and the others contract for service from the lead entity, or an overlapping entity is created to own the project and all parties contract with the overlapping entity (a MUD, for example).

TCEQ regulations and others can be an institutional barrier to consolidation. Generally TCEQ must approve the sale or transfer of fixed assets, and TCEQ must approve any transfer or amendment of certificates of convenience and necessity. TCEQ also must approve creation of a municipal or special utility district, which may also require action of the county commissioner's court or the state legislature.

Ultimately, for very small systems, consolidation will become essential to survival. Increasing regulatory compliance pressures, increasing costs, and limits on water supply are all growing influences which will compel consolidation.

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TABLE 2 – Potential Systems to Consolidate

						NEEDS/SURPLUSES							
WUG NAME	**COUNTY**	**CCN**	**SOURCE NAME**	**NUMBER OF CONNEC-TIONS**	**REMARKS**	**2010 (A-F)**	**2020 (A-F)**	**2030 (A-F)**	**2040 (A-F)**	**2050 (A-F)**	**2060 (A-F)**	**Water Mgmt Strategy**	**Potential Water Supplier**
CLUSTER #1, HOPKINS COUNTY													
CORNERS-VILLE WSC	HOPKINS	12401	Carrizo-Wilcox Aquifer	343		104	90	84	80	94	106	-	
COMO	HOPKINS	P0601	Carrizo-Wilcox Aquifer	280		53	43	35	29	29	29	-	
MARTIN SPRINGS WSC	HOPKINS	12302	Cooper Reservoir/ Carrizo-Wilcox Aquifer	1037	Buys from City of Sulphur Springs	236	193	172	160	203	242	-	City of Sulphur Springs or City of Winnsboro
PICKTON WSC	HOPKINS	11001	Carrizo-Wilcox Aquifer	223		16	7	3	1	9	17	-	
				1883									
CLUSTER #2, HOPKINS COUNTY													
BRASHEAR WSC	HOPKINS	10498	Cooper Reservoir	352	Buys from City of Sulphur Springs	0	0	0	0	0	0	-	
MILLER GROVE WSC (Hopkins/Rains /Hunt)	HOPKINS	11279	Nacatoch Aquifer	503		15	6	-24	-30	-17	-6		
PLEASANT HILL WSC #2	HOPKINS	10512	Cooper Reservoir	87	Buys from City of Sulphur Springs	0	0	0	0	0	0	-	City of Sulphur Springs

							NEEDS/SURPLUSES							
WUG NAME	**COUNTY**	**CCN**	**SOURCE NAME**	**NUMBER OF CONNEC-TIONS**	**REMARKS**		**2010 (A-F)**	**2020 (A-F)**	**2030 (A-F)**	**2040 (A-F)**	**2050 (A-F)**	**2060 (A-F)**	**Water Mgmt Strategy**	**Potential Water Supplier**
SHADY GROVE WSC 2	HOPKINS	10507	Cooper Reservoir	125	Buys from City of Sulphur Springs		0	0	0	0	0	0	-	
SHIRLEY WSC (Hopkins/Rains	HOPKINS	11229	Carrizo-Wilcox Aquifer	650			121	85	67	59	80	99	-	
				1717										
CLUSTER #3, RAINS COUNTY														
BRIGHT STAR-SALEM (Rains/Wood)	RAINS	10404	Carrizo-Wilcox Aquifer	1724			178	85	28	14	17	26	-	
EAST TAWAKONI	RAINS	P0513	Lake Tawakoni	560	Buys from City of Emory		377	356	336	315	293	270	-	City of Emory
EMORY	RAINS	10495	Lake Tawakoni	899			764	743	721	701	677	652	-	
SOUTH RAINS WSC	RAINS	10487	Lake Tawakoni	984	Buys from City of Emory		-160	-239	-284	-295	-287	-277	City of Emory, Lake Tawakoni	
				4167										
CLUSTER #4, VAN ZANDT COUNTY														
CANTON NORTH ESTATES	VAN ZANDT	12481	Carrizo-Wilcox Aquifer	34			26	26	26	26	26	26	-	
CORINTH WSC	VAN ZANDT	10769	Carrizo-Wilcox Aquifer	310			56	37	21	10	-6	-23	1 well, Carrizo-Wilcox	
CROOKED CREEK WSC	VAN ZANDT	11618	Carrizo-Wilcox Aquifer	265			7	-8	-21	-30	-42	-56	1 well, Carrizo-Wilcox	

							NEEDS/SURPLUSES							
WUG NAME	**COUNTY**	**CCN**	**SOURCE NAME**	**NUMBER OF CONNEC-TIONS**	**REMARKS**		**2010 (A-F)**	**2020 (A-F)**	**2030 (A-F)**	**2040 (A-F)**	**2050 (A-F)**	**2060 (A-F)**	**Water Mgmt Strategy**	**Potential Water Supplier**
FRUITVALE WSC	VAN ZANDT	10806	Carrizo-Wilcox Aquifer	1059			0	-64	-119	-159	-211	-269	7 wells, Carrizo-Wilcox	City of Edgewood
LITTLE HOPE-MOORE WSC	VAN ZANDT	11263	Carrizo-Wilcox Aquifer	550			-13	-48	-78	-101	-129	-161	5 wells, Carrizo-Wilcox	
MYRTLE SPRINGS WSC	VAN ZANDT	11200	Carrizo-Wilcox Aquifer	438			157	146	136	129	119	109	-	
PRUITT-SANDFLAT WSC	VAN ZANDT	10746	Carrizo-Wilcox Aquifer	442			230	204	182	165	145	121	-	
				3098										
CLUSTER #5, VAN ZANDT COUNTY														
BEN WHEELER WSC (Van Zandt/Smith)	VAN ZANDT	10749	Carrizo-Wilcox Aquifer	725			174	134	101	77	44	9	-	
EDOM WSC (Van Zandt/Henderson	VAN ZANDT	10747	Carrizo-Wilcox Aquifer	453			-32	-53	-72	-86	-104	-124	5 wells, Carrizo-Wilcox	
MARTINS MILL WSC	VAN ZANDT	12583	Carrizo-Wilcox Aquifer	68			15	12	9	7	4	2	-	City of Tyler
R-P-M WSC	VAN ZANDT	10787	Carrizo-Wilcox Aquifer	735			20	-8	-30	-46	-70	-99	2 wells, Carrizo-Wilcox	
TEXAS WATER SERVICES, INC. CALLENDER LAKE SUBDIVISION	VAN ZANDT	12983	Carrizo-Wilcox Aquifer	646			71	71	71	71	71	71	-	
				2627										

							NEEDS/SURPLUSES						
WUG NAME	**COUNTY**	**CCN**	**SOURCE NAME**	**NUMBER OF CONNEC-TIONS**	**REMARKS**		**2010 (A-F)**	**2020 (A-F)**	**2030 (A-F)**	**2040 (A-F)**	**2050 (A-F)**	**2060 (A-F)**	**Water Mgmt Strategy**	**Potential Water Supplier**
CLUSTER #6, HARRISON COUNTY														
BLOCKER-CROSSROADS WSC	HARRISON	12687	Carrizo-Wilcox Aquifer	362			-78	-91	-100	-107	-116	-128	3 wells, Carrizo-Wilcox Aquifer	
ELYSIAN FIELDS WSC	HARRISON	10366	Cypress Aquifer	271			37	29	22	18	12	4	-	
GILL WSC	HARRISON	10365	Carrizo-Wilcox/ Cypress Aquifer	835	Buys from City of Marshall		128	103	85	72	56	33	-	Groundwater
OLD TOWN WSC	HARRISON	12119	Cypress Aquifer	30		*	0	0	0	0	0	0	-	
CITY OF SCOTTSVILLE	HARRISON	10363	Cypress Aquifer	308			36	25	17	11	3	-7	1 well, Carrizo-Wilcox Aquifer	
WASKOM RURAL WSC #1	HARRISON	11628	Carrizo-Wilcox Aquifer	284			49	39	32	26	20	11	-	
				2090										
CLUSTER #7, HARRISON COUNTY														
CADDO LAKE WSC	HARRISON	10367	Carrizo-Wilcox/ Cypress Aquifer	282			10	-6	-19	-27	-37	-52	2 wells, Carrizo-Wilcox Aquifer	
CYPRESS VALLEY WSC	HARRISON	10364	Cypress Aquifer	377	Buys from City of Marshall		67	53	42	34	25	11	-	
KARNACK WSC	HARRISON	10428	Carrizo-Wilcox Aquifer	210			48	39	33	28	22	14	-	

							NEEDS/SURPLUSES							
WUG NAME	**COUNTY**	**CCN**	**SOURCE NAME**	**NUMBER OF CONNEC-TIONS**	**REMARKS**		**2010 (A-F)**	**2020 (A-F)**	**2030 (A-F)**	**2040 (A-F)**	**2050 (A-F)**	**2060 (A-F)**	**Water Mgmt Strategy**	**Potential Water Supplier**
LEIGH WSC	HARRISON	10413	Cypress Aquifer	404	Buys from City of Marshall		84	52	30	13	-7	-36	1 well, Carrizo-Wilcox Aquifer	Groundwater
NORTH HARRISON WSC	HARRISON	10415	Carrizo-Wilcox/ Queen City Aquifer	415			74	61	51	44	35	23	-	
SHADOWOOD WATER CO.	HARRISON	11568	Cypress Aquifer	90			32	32	32	32	32	32	-	
TALLEY WSC	HARRISON	10414	Cypress Aquifer	550	Buys from City of Marshall		-59	-81	-97	-109	-122	-142	3 wells, Carrizo-Wilcox Aquifer	
CYPRESS VILLAGE	HARRISON	11763	Carrizo-Wilcox	115			-6	-6	-7	-7	-8	-8		
				2443										
CLUSTER #8, UPSHUR COUNTY														
CITY OF CLARKSVILLE	GREGG	11048	Lake Gladewater	318	Buys from City of Gladewater		6	5	5	4	3	2	-	
CITY OF EAST MOUNTAIN	UPSHUR	12972	Carrizo-Wilcox Aquifer	600			163	162	153	143	137	127	-	
GLENWOOD WSC	UPSHUR	10515	Carrizo-Wilcox Aquifer	857	Buys from NETMWD		531	506	490	479	470	455	-	Groundwater
UNION GROVE WSC	UPSHUR	10514	Carrizo-Wilcox Aquifer	830			443	443	443	443	443	443	-	
CITY OF WARREN CITY	GREGG		Lake Gladewater	126	Buys from City of Gladewater		185	180	174	168	159	144	-	
				2731										

							NEEDS/SURPLUSES							
WUG NAME	**COUNTY**	**CCN**	**SOURCE NAME**	**NUMBER OF CONNEC-TIONS**	**REMARKS**		**2010 (A-F)**	**2020 (A-F)**	**2030 (A-F)**	**2040 (A-F)**	**2050 (A-F)**	**2060 (A-F)**	**Water Mgmt Strategy**	**Potential Water Supplier**
CLUSTER #9, SMITH COUNTY														
STAR MOUNTAIN WSC	SMITH	11720	Carrizo-Wilcox Aquifer	504			62	33	16	-1	-36	-83	1 well, Carrizo-Wilcox Aquifer	
STARRVILLE-FRIENDSHIP WSC	SMITH	10360	Carrizo-Wilcox Aquifer/ Lake Gladewater	509	Buys from City of Gladewater		33	22	13	3	-11	-19	1 well, Carrizo-Wilcox Aquifer	Groundwater
STARRVILLE WSC	SMITH	12897	*	239		*	0	0	0	0	0	0	-	
				1252										
CLUSTER #10, SMITH COUNTY														
DUCK CREEK WSC	SMITH	10775	Carrizo-Wilcox Aquifer	697				3	28	57	75	79	-	
ENCHANTED LAKES WATER CO.	SMITH	11516	Carrizo-Wilcox Aquifer	161			187	187	187	187	187	187	-	
LINDALE RURAL WSC	SMITH	10758	Carrizo-Wilcox Aquifer	2300			137	93	48	4	-77	-187	1 well, Carrizo-Wilcox Aquifer	Groundwater
PINE RIDGE WSC	SMITH	10778	Carrizo-Wilcox Aquifer	493			78	108	142	176	196	220	-	
				3651										
* No information available														

VI. Sub Regional Plans

Cluster #1, Hopkins County

Cluster #1 is located in southwestern Hopkins County and consists of four water systems identified for consolidation — Cornersville WSC, City of Como, Martin Springs WSC and Pickton WSC. Water supply for the four systems is predominantly from the Carrizo-Wilcox. The consolidated system would have 1,883 current connections, growing to 2224 by 2025. A water demand and supply analysis shows that each system will have a supply surplus during the planning period of 2010 to 2060. An average median household income of $31,084 was calculated for the four systems, and the corresponding monthly average water bill at 1.5% of the median household income was estimated as $38.85.

These four water user groups have the option of combining together and continuing to use ground water from the Carrizo-Wilcox as their source of supply. By merging together, the systems would enjoy the benefits of improved technical, financial and managerial capacity. An alternative option would be for the four systems to convert to surface water purchase from the City of Sulphur Springs. Approximately 53,000 feet of new water pipeline is needed to supply water to the clusters from Sulphur Springs. A cost estimate performed for this water purchase option resulted in a $31.53 increased monthly water cost per connection (which does not include operation and maintenance costs). Because the water bill cost estimated based on 1.5% of the median household income was only $38.85, water purchase from City of Sulphur Springs does not appear to be an economical alternative for this cluster of systems.

Attachment A – Surface Water worksheet - Cluster #1 - Hopkins County

Water Purchase Contract With City of Sulphur Springs:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
740,976	**830.0**	$ 2.50

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
53,000	8	$ 1.67	$ 708,080.00	$ 24,782.80	$ 732,862.80

Total Construction Cost	**$ 732,862.80**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 219,858.84
INTEREST DURING CONSTRUCTION (3%)	$ 21,985.88
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL CAPITAL COST	**$ 994,707.52**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	761	836	876	900	834	775	830
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 619,681.84	$ 681,159.12	$ 713,465.41	$ 733,154.53	$ 679,804.88	$ 631,350.79	$ 676,436.09
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 691,897.60**	**$ 753,374.89**	**$ 785,681.17**	**$ 733,154.53**	**$ 679,804.88**	**$ 631,350.79**	**$ 712,543.98**

UNIT COST ($ / ac-ft / yr)	**$ 858.11**
NUMBER OF CONNECTIONS	**1,883**
TOTAL PERSONS SERVED (3 x Number of Connections)	**5,649**
COST PER CONNECTION (Annual Average Water Purchase Cost / Connections / 12) **(Does not include maintenance and operation costs)**	**$ 31.53**
MONTHLY AVERAGE WATER BILL @1.5% MEDIAN HOUSEHOLD INCOME	**$ 38.85**

Location Map For Cluster #1

TABLES FOR CLUSTER #1

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 1

TABLE 1-1-A

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Como

Number of Connections: 280

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	261,000	1,280	---	100,000
2	165				
TOTALS	265	261,000	1,280	---	100,000
REQUIRED CAPACITY	168	56,000	560	---	28,000
SURPLUS	97	205,000	720	**---**	72,000
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 1

TABLE 1-2-A

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Como

Number of Connections: 280 (Existing) + 42 (Proposed) = 322

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	261,000	1,280	---	100,000
2	165				
TOTALS	265	261,000	1,280	---	100,000
REQUIRED CAPACITY	193	64,400	644	---	32,200
SURPLUS	72	196,600	636	---	67,800
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 1

TABLE 1-1-B

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Cornersville WSC

Number of Connections: 343

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	250,000	---	---	250,000
2	100				
3	250				
TOTALS	450	250,000	---	---	250,000
REQUIRED CAPACITY	206	68,600	---	---	34,300
SURPLUS	244	181,400	---	---	215,700
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 1

TABLE 1-2-B

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Cornersville WSC

Number of Connections: 343 (Existing) + 60 (Projected) = 403

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	250,000	---	---	250,000
2	100				
3	250				
TOTALS	450	250,000	---	---	250,000
REQUIRED CAPACITY	242	80,600	---	---	40,300
SURPLUS	208	169,400	---	---	209,700
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 1

TABLE 1-1-C

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Martin Springs WSC

Number of Connections: 1,037

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	185	350,000	---	---	350,000
2	300				
3	100				
4	60				
5	100				
6	100				
TOTALS	845	350,000	---	---	350,000
REQUIRED CAPACITY	622	207,400	---	---	103,700
SURPLUS	223	142,600	---	---	246,300
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 1

TABLE 1-2-C

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Martin Springs WSC

Number of Connections: 1,037 (Existing) + 195 (Projected) = 1,232

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	185	350,000	---	---	350,000
2	300				
3	100				
4	60				
5	100				
6	100				
TOTALS	845	350,000	---	---	350,000
REQUIRED CAPACITY	739	246,400	---	---	123,200
SURPLUS	106	103,600	---	---	226,800
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 1

TABLE 1-1-D

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Pickton WSC

Number of Connections: 223

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	100,000	---	---	100,000
2	100				
TOTALS	200	100,000	---	---	100,000
REQUIRED CAPACITY	134	44,600	---	---	22,300
SURPLUS	66	55,400	---	---	77,700
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 1

TABLE 1-2-D

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Pickton WSC

Number of Connections: 223 (Existing) + 44 (Projected) = 267

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	100,000	---	---	100,000
2	100				
TOTALS	200	100,000	---	---	100,000
REQUIRED CAPACITY	160	53,400	---	---	26,700
SURPLUS	40	46,600	---	---	73,300
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 1

TABLE 1-3

COMBINED CAPACITY BY SUB-REGION
EXISTING CONDITIONS

Sub Region # 1: Como, Cornersville WSC, Martin Springs WSC, Pickton WSC

Number of Connections: 1,883

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Como	265	261,000	1,280	---	100,000
Cornersville	450	250,000	---	---	250,000
Martin Springs	845	350,000	---	---	350,000
Pickton	200	100,000	---	---	100,000
TOTALS	1,760	961,000	1,280	---	800,000
REQUIRED CAPACITY	1,130	376,600	3,766	---	188,300
SURPLUS	630	584,400	---	---	611,700
DEFICIENCY	---	---	2,486	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 1

TABLE 1-4

COMBINED CAPACITY BY SUB-REGION
PROPOSED CONDITIONS TO 2025

Sub Region # 1: Como, Cornersville WSC, Martin Springs WSC, Pickton WSC

Number of Connections: 1,883 (Existing) + 341 (Projected) = 2,224

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Como	265	261,000	1,280	---	100,000
Cornersville	450	250,000	---	---	250,000
Martin Springs	845	350,000	---	---	350,000
Pickton	200	100,000	---	---	100,000
TOTALS	1,760	961,000	1,280	---	800,000
REQUIRED CAPACITY	1,334	444,800	4,448	---	222,400
SURPLUS	3,094	516,200	---	---	577,600
DEFICIENCY	---	---	3,168	---	---

Cluster #2, Hopkins County

Cluster #2 is located in southeastern Hopkins County, and includes — Brashear WSC (352 connections), Shady Grove WSC (125), Shirley WSC (650), Miller Grove WSC (503), and Pleasant Hill WSC #2 (87). These five systems would have a total of 1717 meters now, growing to 2228 by the year 2025.

Brashear, Shady Grove #2 and Pleasant Hill #2 currently contract with the City of Sulphur Springs, and Sulphur Springs has an adequate supply throughout the planning period. Shirley WSC obtains water from the Carrizzo-Wilcox and its supply is projected to be adequate throughout the planning period. Miller Grove WSC obtains its supply from the Nacatoch aquifer and is projected to experience a deficit around 2030.

Consolidation of these systems would allow Miller Grove to utilize excess existing capacity via an interconnection with Shirley WSC or Brashear WSC and avoid the capital expense of an additional well. In addition, the system would benefit from a combined operation as discussed in the section herein entitled “Financial, Managerial and Technical Capabilities.”

The combined systems have a median household income of $34,502, which at 1½ % of MHI suggests an average monthly bill of $43.12. The estimated capital cost for 6 miles of 6" interconnect piping is $430,790, which, spread over 1717 meters at 6%, 30 years, would increase the average monthly bill by $1.53. Particularly considering the FMT benefits, this consolidation appears to have potential.

Attachment A – Surface Water worksheet - Cluster #2 - Hopkins County

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
30,000	6	$ 1.67	$ 300,600.00	$ 10,521.00	$ 311,121.00

Total Construction Cost **$ 311,121.00**

Other Capital Costs

ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 93,336.30
INTEREST DURING CONSTRUCTION (3%)	$ 9,333.63
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL CAPITAL COST	**$ 433,790.93**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	0	0	0	0	0	775	129
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 31,493.22**	**$ 31,493.22**	**$ 31,493.22**	**$ 31,493.22**	**$ 31,493.22**	**$ 31,493.22**	**$ 31,493.22**

UNIT COST **$ 243.81**
($ / ac-ft / yr)

NUMBER OF CONNECTIONS **1,717**

TOTAL PERSONS SERVED (3 x Number of Connections) **5,151**

COST PER CONNECTION (Annual Average Water Purchase Cost / Connections / 12) **$ 1.53**
(Does not include maintenance and operation costs)

MONTHLY AVERAGE WATER BILL @1.5% MEDIAN HOUSEHOLD INCOME **$ 43.12**

Location Map for Cluster #2

TABLES FOR CLUSTER #2

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-1-A

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Brashear WSC

Number of Connections: 352

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	100,000	640	6,000	---
TOTALS	---	100,000	640	6,000	---
REQUIRED CAPACITY	---	70,400	704	7,040	---
SURPLUS	---	29,600	---	---	---
DEFICIENCY	---	---	64	1,040	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-2-A

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Brashear WSC

Number of Connections: 352 (Existing) + 49 (Projected) = 401

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	100,000	640	6,000	---
TOTALS	---	100,000	640	6,000	---
REQUIRED CAPACITY	---	80,200	802	8,020	---
SURPLUS	---	19,800	---	---	---
DEFICIENCY	---	---	162	2,020	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-1-B

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Miller Grove WSC

Number of Connections: 503

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	65	190,000	1,000	10,100	18,000
2	57				
3	58				
4	31				
5	76				
6	50				
7	75				
TOTALS	412	190,000	1,000	10,100	18,000
REQUIRED CAPACITY	302	100,600	1,000	10,060	---
SURPLUS	110	89,400	---	40	18,000
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-2-B

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Miller Grove WSC

Number of Connections: 503 (Existing) + 166 (Proposed) = 669

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	65	190,000	1,000	10,100	18,000
2	57				
3	58				
4	31				
5	76				
6	50				
7	75				
TOTALS	412	190,000	1,000	10,100	18,000
REQUIRED CAPACITY	401	133,800	1,000	13,380	---
SURPLUS	11	56,200	---	---	18,000
DEFICIENCY	---	---	---	3,280	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-1-C

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Pleasant Hill WSC #2

Number of Connections: 87

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	34,000	---	---	13,000
TOTALS	---	34,000	---	---	13,000
REQUIRED CAPACITY	---	17,400	---	---	8,700
SURPLUS	---	16,600	---	---	4,300
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-2-C

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Pleasant Hill WSC #2

Number of Connections: 87 (Existing) + 3 (Projected) = 90

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	34,000	---	---	13,000
TOTALS	---	34,000	---	---	13,000
REQUIRED CAPACITY	---	18,000	---	---	9,000
SURPLUS	---	16,000	---	---	4,000
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-1-D

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Shady Grove WSC #2

Number of Connections: 125

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	100,000	520	6,000	---
TOTALS	---	100,000	520	6,000	---
REQUIRED CAPACITY	---	25,000	250	2,500	---
SURPLUS	---	75,000	270	3,500	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-2-D

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Shady Grove WSC #2

Number of Connections: 125 (Existing) + 104 (Projected) = 229

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	100,000	520	6,000	---
TOTALS	---	100,000	520	6,000	---
REQUIRED CAPACITY	---	45,800	458	4,580	---
SURPLUS	---	54,200	62	1,420	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-1-E

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Shirley WSC

Number of Connections: 650

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	70	800,000	1,430	26,000	150,000
2	95				
3	120				
4	95				
5	100				
6	150				
7	115				
TOTALS	745	800,000	1,430	26,000	150,000
REQUIRED CAPACITY	390	130,000	1,000	---	65,000
SURPLUS	355	670,000	430	26,000	85,000
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-2-E

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Shirley WSC

Number of Connections: 650 (Existing) + 189 (Projected) = 839

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	70	800,000	1,430	26,000	150,000
2	95				
3	120				
4	95				
5	100				
6	150				
7	115				
TOTALS	745	800,000	1,430	26,000	150,000
REQUIRED CAPACITY	503	167,800	1,000	---	83,900
SURPLUS	242	632,200	430	26,000	66,100
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-3

COMBINED CAPACITY BY SUB-REGION
EXISTING CONDITIONS

Sub Region # 2: Brashear WSC, Miller Grove WSC, Pleasant Hill WSC #2, Shady Grove WSC #2, Shirley WSC

Number of Connections: 1,717

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Brashear	---	100,000	640	6,000	---
Miller Grove	412	190,000	1,000	10,100	18,000
Pleasant Hill	---	34,000	---	---	13,000
Shady Grove	---	100,000	520	6,000	---
Shirley	745	800,000	1,430	26,000	150,000
TOTALS	1,157	1,224,000	3,590	48,100	181,000
REQUIRED CAPACITY	1,030	343,400	3,434	34,340	171,700
SURPLUS	127	880,600	156	13,760	9,300
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 2

TABLE 2-4

COMBINED CAPACITY BY SUB-REGION
PROPOSED CONDITIONS TO 2025

Sub Region # 2: Brashear WSC, Miller Grove WSC, Pleasant Hill WSC #2, Shady Grove WSC #2, Shirley WSC

Number of Connections: 1,717 (Existing) + 511 (Projected) = 2,228

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Brashear	---	100,000	640	6,000	---
Miller Grove	412	190,000	1,000	10,100	18,000
Pleasant Hill	---	34,000	---	---	13,000
Shady Grove	---	100,000	520	6,000	---
Shirley	745	800,000	1,430	26,000	150,000
TOTALS	1,157	1,224,000	3,590	48,100	181,000
REQUIRED CAPACITY	1,337	445,600	4,456	44,560	222,800
SURPLUS	---	778,400	---	3,540	---
DEFICIENCY	180	---	866	---	41,800

Cluster #3. Rains County

Cluster #3 is located in Rains County, and includes — Bright Star-Salem WSC (1724 connections), City of Emory (899), City of East Tawakoni (560), City of Alba (317), and the South Rains WSC (984) connections. These five systems would have a total of 4484 connections now, growing to 5669 by the year 2025.

East Tawakoni and South Rains WSC currently contract with the City of Emory, and Emory has an adequate supply through the planning period from Lake Tawakoni. Bright Star obtains its supply from the Carrizo-Wilcox via a large number of low-yielding wells. Bright Star also has a 0.75 MGD contract with the Sabine River Authority for water from Lake Fork. Alba is supplied by two wells in the Carrizo-Wilcox aquifer which are marginal throughout the planning period. Bright Star's supply is marginal in quality and quantity and will likely change to surface water in the foreseeable future. South Rains has a supply deficit now and throughout the planning period.

Consolidation of these systems would result in many of the benefits described in the section herein entitled “Financial, Managerial, and Technical Capabilities.” The consolidation project would include a new 1 MGD water treatment plant to utilize Bright Star's contracted Lake Fork water. About 5 miles of pipeline would be constructed to connect the new plant to the Emory system. The Emory system is already connected to East Tawakoni and South Rains. A connection would be made between Bright Star and Alba.

The combined systems have a median household income of $33,452 which, at 1½ % of MHI suggests an average monthly bill of $41.10 is affordable. The estimated capital cost for the new plant and interconnecting pipeline is $4.33 million which, spread over 4484 connections at 6%, 30 years, would increase the average monthly bill by $8 - $9 initially, dropping to $2 - $3 after the debt is retired. This consolidation appears to be worth further consideration.

Attachment A – Surface Water worksheet - Cluster #3 - Rains County

Water treatment costs

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
500,000	**560.1**	$ 0.75

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
25,000	8	$ 1.67	$ 334,000.00	$ 11,690.00	$ 345,690.00
Alba Connection					$ 50,000.00
1 MGD water treatment plant and intake			2750000	$ 96,250.00	$ 2,846,250.00
Total Construction Cost					**$ 3,241,940.00**

Other Capital Costs

ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 972,582.00
INTEREST DURING CONSTRUCTION (3%)	$ 97,258.20
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL CAPITAL COST	**$ 4,331,780.20**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	560	560	560	560	560	560	560
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 136,881.86	$ 136,881.86	$ 136,881.86	$ 136,881.86	$ 136,881.86	$ 136,881.86	$ 136,881.86
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 451,369.10**	**$ 451,369.10**	**$ 451,369.10**	**$ 136,881.86**	**$ 136,881.86**	**$ 136,881.86**	**$ 294,125.48**

UNIT COST ($ / ac-ft / yr)	**$ 525.13**
NUMBER OF CONNECTIONS	**4,484**
TOTAL PERSONS SERVED (3 x Number of Connections)	**13,452**
COST PER CONNECTION (Annual Average Water Purchase Cost / Connections / 12) **(Does not include maintenance and operation costs)**	**$ 5.47**
MONTHLY AVERAGE WATER BILL @1.5% MEDIAN HOUSEHOLD INCOME	**$ 41.81**

Location Map – Cluster #3

TABLES FOR CLUSTER #3

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-1-A

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Alba

Number of Connections: 317

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	210	125,000	800	---	50,000
TOTALS	210	125,000	800	---	50,000
REQUIRED CAPACITY	190	63,400	634	---	31,700
SURPLUS	20	61,600	166	---	18,300
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-2-A

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Alba

Number of Connections: 317 (Existing) + 82 (Projected) = 399

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	210	125,000	800	---	50,000
TOTALS	210	125,000	800	---	50,000
REQUIRED CAPACITY	239	79,800	798	---	39,900
SURPLUS	---	45,200	2	---	10,100
DEFICIENCY	29	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-1-B

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Bright Star-Salem

Number of Connections: 1,724

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	40	890,000	4,903	24,000	325,000
2	370				
3	186				
4	60				
5	100				
6	35				
7	85				
8	35				
9	110				
10	50				
11	85				
12	40				
13	100				
TOTALS	1,296	890,000	4,903	24,000	325,000
REQUIRED CAPACITY	1,034	344,800	3,448	---	172,400
SURPLUS	262	545,200	1,455	24,000	152,600
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-2-B

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Bright Star-Salem

Number of Connections: 1,724 (Existing) + 265 (Projected) = 1,989

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	40	890,000	4,903	24,000	325,000
2	370				
3	186				
4	60				
5	100				
6	35				
7	85				
8	35				
9	110				
10	50				
11	85				
12	40				
13	100				
TOTALS	1,296	890,000	4,903	24,000	325,000
REQUIRED CAPACITY	1,193	397,800	3,978	---	198,900
SURPLUS	103	492,200	925	24,000	126,100
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-1-C

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: East Tawakoni

Number of Connections: 560

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	75,000	1,250	---	75,000
TOTALS	---	75,000	1,250	---	75,000
REQUIRED CAPACITY	---	112,000	1,120	---	56,000
SURPLUS	---	---	130	---	19,000
DEFICIENCY	---	37,000	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-2-C

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: East Tawakoni

Number of Connections: 560 (Existing) + 163 (Projected) = 723

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	75,000	1,250	---	75,000
TOTALS	---	75,000	1,250	---	75,000
REQUIRED CAPACITY	---	144,600	1,446	---	72,300
SURPLUS	---	---	---	---	2,700
DEFICIENCY	---	69,600	196	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-1-D

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Emory

Number of Connections: 899

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	807,000	9,010	10,000	150,000
TOTALS	---	807,000	9,010	10,000	150,000
REQUIRED CAPACITY	---	179,800	1,798	---	89,900
SURPLUS	---	627,200	7,212	10,000	60,100
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-2-D

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Emory

Number of Connections: 899 (Existing) + 289 (Projected) = 1,188

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	807,000	9,010	10,000	150,000
TOTALS	---	807,000	9,010	10,000	150,000
REQUIRED CAPACITY	---	237,600	2,376	---	118,800
SURPLUS	---	569,400	6,634	10,000	31,200
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-1-E

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: South Rains WSC

Number of Connections: 984

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	390,000	1,240	15,000	100,000
TOTALS	---	390,000	1,240	15,000	100,000
REQUIRED CAPACITY	---	196,800	1,968	---	98,400
SURPLUS	---	193,200	---	15,000	1,600
DEFICIENCY	---	---	728	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-2-E

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: South Rains WSC

Number of Connections: 984 (Existing) + 386 (Projected) = 1,370

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
---	---	390,000	1,240	15,000	100,000
TOTALS	---	390,000	1,240	15,000	100,000
REQUIRED CAPACITY	---	274,000	2,740	---	137,000
SURPLUS	---	116,000	---	15,000	---
DEFICIENCY	---	---	1,500	---	37,000

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-3

COMBINED CAPACITY BY SUB-REGION
EXISTING CONDITIONS

Sub Region # 3: Alba, Bright Star-Salem, East Tawakoni, Emory, South Rains WSC

Number of Connections: 4,484

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Alba	210	125,000	800	---	50,000
Bright Star-Salem	1,296	890,000	4,903	24,000	325,000
East Tawakoni	---	75,000	1,250	---	75,000
Emory	---	807,000	9,010	10,000	150,000
South Rains	---	390,000	1,240	15,000	100,000
TOTALS	1,506	2,287,000	17,203	49,000	700,000
REQUIRED CAPACITY	2,690	896,800	8,968	89,680	448,400
SURPLUS	---	1,390,200	8,235	---	251,600
DEFICIENCY	1,184	---	---	40,680	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 3

TABLE 3-4

COMBINED CAPACITY BY SUB-REGION
PROPOSED CONDITIONS TO 2025

Sub Region # 3: Alba, Bright Star-Salem, East Tawakoni, Emory, South Rains WSC

Number of Connections: 4,484 (Existing) + 1,185 (Projected) = 5,669

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Alba	210	125,000	800	---	50,000
Bright Star-Salem	1,296	890,000	4,903	24,000	325,000
East Tawakoni	---	75,000	1,250	---	75,000
Emory	---	807,000	9,010	10,000	150,000
South Rains	---	390,000	1,240	15,000	100,000
TOTALS	1,506	2,287,000	17,203	49,000	700,000
REQUIRED CAPACITY	3,401	1,133,800	11,338	113,380	566,900
SURPLUS	---	1,153,200	5,865	---	133,100
DEFICIENCY	1,895	---	---	64,380	---

Cluster #4, Van Zandt County

Cluster #4 is located in central Van Zandt County and consists of seven water systems identified for consolidation — Canton North Estates, Corinth WSC, Crooked Creek WSC, Fruitvale WSC, Little Hope-Moore WSC, Myrtle Springs WSC and Pruit-Sandflat WSC. Water supply for the seven systems is from the Carrizo-Wilcox. The consolidated system would have 3,098 current connections, growing to 4,387 by 2025. A water demand and supply analysis shows that four systems will have a supply deficit during the planning period of 2010 to 2060. As a consolidated system, a deficit of 98 ac-ft/yr will occur in 2050 and increasing to a deficit of 253 ac-ft/yr by 2060. An average median household income of $33,560 was calculated for the seven systems, and the corresponding monthly average water bill at 1.5% of the median household income was estimated as $41.95.

There is no wholesale water provider located near this cluster. Cost estimates for water purchase from the City of Tyler resulted in a unit cost of $798/ac-ft/year while the cost of drilling three additional wells was $261/ac-ft/year. Converting to surface water from the City of Tyler, which is located more than 20 miles away would not be a feasible economic alternative. These seven water user groups have the option of combining together and continuing to use ground water from the Carrizo-Wilcox as their source of supply. By merging together, the systems would enjoy the benefits of improved technical, financial and managerial capacity.

The additional cost for capital would result in an increase of between $2.50 and $3.00 per meter per month. This consolidation would appear to warrant further study.

Attachment A – Groundwater worksheet - Cluster #4 – Van Zandt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
3	560	180	**290**	$ 334.00	$ 561,120.00	$ 5,611.20	$ 566,731.20

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
7,500	6	$ 2.23	$ 100,350.00	$ 3,512.25	$ 103,862.25

Total Construction Cost	**$ 670,593.45**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 201,178.04
INTEREST DURING CONSTRUCTION (3%)	$ 20,117.80
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL CAPITAL COST	**$ 911,889.29**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,829 * $ 0.45/ 1,000)	$ 42,573.18
TOTAL ANNUALIZED COST (O & M Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 108,776.34**
WUG Total WMS Cost Per Acre-Foot (TWDB Calculated)	**$ 261.00**

Attachment B – Surface Water worksheet - Cluster #4 – Van Zandt County

(Please see next page)

Water Purchase Contract With City of Tyler:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
1,593,545	**1785.0**	$ 2.26

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	
2	$ 176,000.00	$ 352,000.00	$ 3,520.00	$ 355,520.00

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
106,000	8	$ 1.67	$ 1,416,160.00	$ 49,565.60	$ 1,465,725.60

Total Construction Cost	**$ 1,821,245.60**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 546,373.68
INTEREST DURING CONSTRUCTION (3%)	$ 54,637.37
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL CAPITAL COST	**$ 2,442,256.65**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	1068	1240	1384	1493	1631	1785	1,434
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 786,761.62	$ 912,996.89	$ 1,019,514.79	$ 1,099,548.79	$ 1,201,026.93	$ 1,314,271.22	$ 1,055,686.71
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 964,069.46**	**$ 1,090,304.72**	**$ 1,196,822.63**	**$ 1,099,548.79**	**$ 1,201,026.93**	**$ 1,314,271.22**	**$ 1,144,340.62**

UNIT COST ($ / ac-ft / yr)	**$ 798.27**
NUMBER OF CONNECTIONS	**3,098**
TOTAL PERSONS SERVED (3 x Number of Connections)	**9,294**
COST PER CONNECTION (Annual Average Water Purchase Cost / Connections / 12) (Does not include maintenance and operation costs)	**$ 30.78**
MONTHLY AVERAGE WATER BILL @1.5% MEDIAN HOUSEHOLD INCOME	**$ 41.95**

Location Map – Cluster #4

TABLES FOR CLUSTER #4

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-1-A

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Canton North Estates WSC

Number of Connections: 34

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	35	---	---	1,740	---
2	35				
TOTALS	70	---	---	1,740	---
REQUIRED CAPACITY	20	6,800	---	680	---
SURPLUS	50	---	---	1,060	---
DEFICIENCY	---	6,800	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-2-A

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Canton North Estates WSC

Number of Connections: 34 (Existing) + 2 (Projected) = 36

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	35	---	---	1,740	---
2	35				
TOTALS	70	---	---	1,740	---
REQUIRED CAPACITY	22	7,200	---	720	---
SURPLUS	48	---	---	1,020	---
DEFICIENCY	---	7,200	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-1-B

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Corinth WSC

Number of Connections: 310

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	130	770,000	1,055	11,700	---
2	75				
3	115				
TOTALS	320	770,000	1,055	11,700	---
REQUIRED CAPACITY	186	62,000	620	6,200	---
SURPLUS	134	708,000	435	5,500	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-2-B

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Corinth WSC

Number of Connections: 310 (Existing) + 134 (Projected) = 444

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	130	770,000	1,055	11,700	---
2	75				
3	115				
TOTALS	320	770,000	1,055	11,700	---
REQUIRED CAPACITY	266	88,800	888	8,880	---
SURPLUS	54	681,200	167	2,820	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-1-C

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Crooked Creek WSC

Number of Connections: 265

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	185	108,000	750	6,500	---
TOTALS	185	108,000	750	6,500	---
REQUIRED CAPACITY	159	53,000	530	5,300	---
SURPLUS	26	55,000	220	1,200	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-2-C

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Crooked Creek WSC

Number of Connections: 265 (Existing) + 88 (Projected) = 353

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	185	108,000	750	6,500	---
TOTALS	185	108,000	750	6,500	---
REQUIRED CAPACITY	212	70,600	706	7,060	---
SURPLUS	---	37,400	44	---	---
DEFICIENCY	27	---	---	560	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-1-D

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Fruitvale WSC

Number of Connections: 1,059

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	48	305,000	2,400	21,000	---
2	30				
3	44				
4	42				
5	66				
6	56				
7	92				
8	80				
9	112				
10	110				
11 + 12	60				
TOTALS	740	305,000	2,400	21,000	---
REQUIRED CAPACITY	635	211,800	2,118	21,180	---
SURPLUS	105	93,200	282	---	---
DEFICIENCY	---	---	---	180	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-2-D

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Fruitvale WSC

Number of Connections: 1,059 (Existing) + 461 (Projected) = 1,520

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	48	305,000	2,400	21,000	---
2	30				
3	44				
4	42				
5	66				
6	56				
7	92				
8	80				
9	112				
10	110				
11 + 12	60				
TOTALS	740	305,000	2,400	21,000	---
REQUIRED CAPACITY	912	304,000	3,040	---	152,000
SURPLUS	---	1,000	---	21,000	---
DEFICIENCY	172	---	640	---	152,000

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-1-E

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Little Hope-Moore WSC

Number of Connections: 550

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	95	207,000	1,110	10,000	---
2	50				
3	56				
4	88				
5	95				
TOTALS	384	207,000	1,110	10,000	---
REQUIRED CAPACITY	330	110,000	1,110	11,000	---
SURPLUS	54	97,000	---	---	---
DEFICIENCY	---	---	---	1,000	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-2-E

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Little Hope-Moore WSC

Number of Connections: 550 (Existing) + 288 (Projected) = 838

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	95	207,000	1,110	10,000	---
2	50				
3	56				
4	88				
5	95				
TOTALS	384	207,000	1,110	10,000	---
REQUIRED CAPACITY	503	167,600	1,676	---	83,800
SURPLUS	---	39,400	---	10,000	---
DEFICIENCY	119	---	566	---	83,800

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-1-F

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Myrtle Springs WSC

Number of Connections: 438

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	158,000	---	---	50,000
2	45				
3	150				
4	30				
5	30				
6	35				
7	35				
TOTALS	425	158,000	---	---	50,000
REQUIRED CAPACITY	263	87,600	876	---	43,800
SURPLUS	162	70,400	---	---	6,200
DEFICIENCY	---	---	876	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-2-F

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Myrtle Springs WSC

Number of Connections: 438 (Existing) + 146 (Projected) = 584

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	158,000	---	---	50,000
2	45				
3	150				
4	30				
5	30				
6	35				
7	35				
TOTALS	425	158,000	---	---	50,000
REQUIRED CAPACITY	350	116,800	1,168	---	58,400
SURPLUS	75	41,200	---	---	---
DEFICIENCY	---	---	1,168	---	8,400

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-1-G

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Pruitt-Sandflat WSC

Number of Connections: 442

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	90	110,000	1,270	11,500	---
2	90				
3	80				
4	90				
5	375				
TOTALS	725	110,000	1,270	11,500	---
REQUIRED CAPACITY	265	88,400	884	8,840	---
SURPLUS	460	21,600	386	2,660	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-2-G

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Pruitt-Sandflat WSC

Number of Connections: 442 (Existing) + 170 (Projected) = 612

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	90	110,000	1,270	11,500	---
2	90				
3	80				
4	90				
5	375				
TOTALS	725	110,000	1,270	11,500	---
REQUIRED CAPACITY	367	122,400	1,224	---	61,200
SURPLUS	358	---	46	11,500	---
DEFICIENCY	---	12,400	---	---	61,200

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-3

COMBINED CAPACITY BY SUB-REGION
EXISTING CONDITIONS

Sub Region # 4: Canton North Estates, Corinth WSC, Crooked Creek WSC, Fruitvale WSC, Little Hope-Moore WSC, Myrtle Springs WSC, Pruitt-Sandflat WSC

Number of Connections: 3,098

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Canton North	70	---	---	1,740	---
Corinth	320	770,000	1,055	11,700	---
Crooked Creek	185	108,000	750	6,500	---
Fruitvale	740	305,000	2,400	21,000	---
Little Hope-Moore	384	207,000	1,110	10,000	---
Myrtle Springs	425	158,000	---	---	50,000
Pruitt-Sandflat	725	110,000	1,270	11,500	---
TOTALS	2,849	1,658,000	6,585	62,440	50,000
REQUIRED CAPACITY	1,859	619,600	6,196	61,960	309,800
SURPLUS	990	1,038,400	389	480	---
DEFICIENCY	---	---	---	---	259,800

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 4

TABLE 4-4

COMBINED CAPACITY BY SUB-REGION
PROPOSED CONDITIONS TO 2025

Sub Region # 4: Canton North Estates, Corinth WSC, Crooked Creek WSC, Fruitvale WSC, Little Hope-Moore WSC, Myrtle Springs WSC, Pruitt-Sandflat WSC

Number of Connections: 3,098 (Existing) + 1,289 (Projected) = 4,387

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Canton North	70	---	---	1,740	---
Corinth	320	770,000	1,055	11,700	---
Crooked Creek	185	108,000	750	6,500	---
Fruitvale	740	305,000	2,400	21,000	---
Little Hope-Moore	384	207,000	1,110	10,000	---
Myrtle Springs	425	158,000	---	---	50,000
Pruitt-Sandflat	725	110,000	1,270	11,500	---
TOTALS	2,849	1,658,000	6,585	62,440	50,000
REQUIRED CAPACITY	2,632	877,400	8,774	87,740	438,700
SURPLUS	217	780,600	---	---	---
DEFICIENCY	---	---	2,189	25,300	388,700

Cluster #5, Van Zandt County

Cluster #5 is located in southeast Van Zandt County and consists of five water systems identified for consolidation — Ben Wheeler WSC, Edom WSC, Martin Mill WSC, R-P-M WSC and Texas Water Services, Inc. Callender Lake Subdivision. Water supply for the five systems is from the Carrizo-Wilcox. The consolidated system would have 2,627 current connections, growing to 3,094 by 2025. A water demand and supply analysis shows that two systems will have a supply deficit during the planning period of 2010 to 2060. As a consolidated system, a deficit of 55 ac-ft/yr will occur in 2050 and increasing to a deficit of 141 ac-ft/yr by 2060. An average median household income of $34,745 was calculated for the five systems, and the corresponding monthly average water bill at 1.5% of the median household income was estimated as $43.43.

Cost estimates for water purchase from the City of Tyler resulted in a unit cost of $789/ac-ft/year while the cost of drilling two additional wells was $261/ac-ft/year. Converting to surface water from the City of Tyler, which is located 14 miles away would not be a feasible economic alternative. These five water user groups have the option of combining together and continuing to use ground water from the Carrizo-Wilcox as their source of supply. By merging together, the systems would enjoy the benefits of improved technical, financial and managerial capacity.

Attachment A – Groundwater worksheet - Cluster #5 – Van Zandt County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
2	560	180	**194**	$ 334.00	$ 374,080.00	$ 3,740.80	$ 377,820.80

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
5,000	6	$ 2.23	$ 66,900.00	$ 2,341.50	$ 69,241.50

Total Construction Cost	**$ 447,062.30**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 134,118.69
INTEREST DURING CONSTRUCTION (3%)	$ 13,411.87
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL CAPITAL COST	**$ 614,592.86**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,829 * $ 0.45/ 1,000)	$ 28,382.12
TOTAL ANNUALIZED COST (O & M Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 73,001.56**
WUG Total WMS Cost Per Acre-Foot	**$261.30**

Attachment B – Surface water worksheet - Cluster #5 – Van Zandt County

Water Purchase Contract With City of Tyler:

Avg. yield (GPD)	Total Yield (ac-ft/yr)	Unit Cost ($ / 1000GAL)
1,593,545	**1785.0**	$ 2.26

Pump Station

Number (ea)	Unit Cost ($ / ea)	Total Cost	Land & Easements (1%)	
1	$ 176,000.00	$ 176,000.00	$ 1,760.00	$ 177,760.00

Treated Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
75,000	8	$ 1.67	$ 1,002,000.00	$ 35,070.00	$ 1,037,070.00

Total Construction Cost	**$ 1,214,830.00**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 364,449.00
INTEREST DURING CONSTRUCTION (3%)	$ 36,444.90
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL CAPITAL COST	**$ 1,635,723.90**

	2010	2020	2030	2040	2050	2060	Average
WATER PURCHASED (ac-ft/yr)	903	1009	1095	1160	1245	1343	1,126
ANNUAL WATER PURCHASE COST (Yield (ac-ft/yr) * 325,851 * $ / 1,000)	$ 665,278.86	$ 743,196.83	$ 806,606.85	$ 854,010.61	$ 917,125.56	$ 988,693.45	$ 829,152.03
							Average
TOTAL ANNUALIZED COST (Water Purchase Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 784,032.41**	**$ 861,950.38**	**$ 925,360.40**	**$ 854,010.61**	**$ 917,125.56**	**$ 988,693.45**	**$ 888,528.80**

UNIT COST ($ / ac-ft / yr)	**$ 789.16**
NUMBER OF CONNECTIONS	**2,627**
TOTAL PERSONS SERVED (3 x Number of Connections)	**7,881**
COST PER CONNECTION (Annual Average Water Purchase Cost / Connections / 12) **(Does not include maintenance and operation costs)**	**$ 28.19**
MONTHLY AVERAGE WATER BILL @1.5% MEDIAN HOUSEHOLD INCOME	**$ 43.43**

Location Map – Cluster #5

TABLES FOR CLUSTER #5

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-1-A

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Ben Wheeler WSC

Number of Connections: 725

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	110	360,000	1,800	19,000	180,000
2	125				
3	90				
4	200				
5	250				
TOTALS	775	360,000	1,800	19,000	180,000
REQUIRED CAPACITY	435	145,000	1,450	---	72,500
SURPLUS	340	215,000	350	19,000	107,500
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-2-A

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Ben Wheeler WSC

Number of Connections: 725 (Existing) + 198 (Projected) = 923

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	110	360,000	1,800	19,000	180,000
2	125				
3	90				
4	200				
5	250				
TOTALS	775	360,000	1,800	19,000	180,000
REQUIRED CAPACITY	554	184,600	1,846	---	92,300
SURPLUS	221	175,400	---	19,000	87,700
DEFICIENCY	---	---	46	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-1-B

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Edom WSC

Number of Connections: 453

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	148,000	1,300	15,000	---
2	60				
3	50				
4	88				
TOTALS	298	148,000	1,300	15,000	---
REQUIRED CAPACITY	272	90,600	906	9,060	---
SURPLUS	26	57,400	394	5,940	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-2-B

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Edom WSC

Number of Connections: 453 (Existing) + 63 (Projected) = 516

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	148,000	1,300	15,000	---
2	60				
3	50				
4	88				
TOTALS	298	148,000	1,300	15,000	---
REQUIRED CAPACITY	310	103,200	1,032	10,320	---
SURPLUS	---	44,800	268	4,680	---
DEFICIENCY	12	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-1-C

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Martins Mill WSC

Number of Connections: 68

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	35	20,000	150	3,000	---
2	28				
TOTALS	63	20,000	150	3,000	---
REQUIRED CAPACITY	41	13,600	136	1,360	---
SURPLUS	22	6,400	14	1,640	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-2-C

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Martins Mill WSC

Number of Connections: 68 (Existing) + 6 (Projected) = 74

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	35	20,000	150	3,000	---
2	28				
TOTALS	63	20,000	150	3,000	---
REQUIRED CAPACITY	44	14,800	148	1,480	---
SURPLUS	19	5,200	2	1,520	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-1-D

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: RPM WSC

Number of Connections: 735

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	70	165,000	600	750	85,000
2	90				
3	150				
4	130				
TOTALS	440	165,000	600	750	85,000
REQUIRED CAPACITY	441	147,000	1,470	---	73,500
SURPLUS	---	18,000	---	750	11,500
DEFICIENCY	1	---	870	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-2-D

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: RPM WSC

Number of Connections: 735 (Existing) + 173 (Projected) = 908

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	70	165,000	600	750	85,000
2	90				
3	150				
4	130				
TOTALS	440	165,000	600	750	85,000
REQUIRED CAPACITY	545	181,600	1,816	---	90,800
SURPLUS	---	---	---	750	---
DEFICIENCY	105	16,600	1,216	---	5,800

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-1-E

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Texas Water Services, Inc.
Callender Lake Subdivision

Number of Connections: 646

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	97	191,000	1,440	14,500	---
2	85				
3	85				
4	270				
TOTALS	537	191,000	1,440	14,500	---
REQUIRED CAPACITY	388	129,200	1,292	12,920	---
SURPLUS	149	61,800	148	1,580	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-2-E

CAPACITY BY WUG

PROJECTED CONDITIONS TO 2025

WUG Name: Texas Water Services, Inc.
Callender Lake Subdivision

Number of Connections: 646 (Existing) + 27 (Projected) = 673

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	97	191,000	1,440	14,500	---
2	85				
3	85				
4	270				
TOTALS	537	191,000	1,440	14,500	---
REQUIRED CAPACITY	404	134,600	1,346	13,460	---
SURPLUS	133	56,400	94	1,040	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-3

COMBINED CAPACITY BY SUB-REGION
EXISTING CONDITIONS

Sub Region # 5: Ben Wheeler WSC, Edom WSC, Martins Mill WSC, RPM WSC, Callender Lake Subdivision

Number of Connections: 2,627

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Ben Wheeler	775	360,000	1,800	19,000	180,000
Edom	298	148,000	1,300	15,000	---
Martins Mill	63	20,000	150	3,000	---
RPM	440	165,000	600	750	85,000
Callender Lake	537	191,000	1,440	14,500	---
TOTALS	2,113	884,000	5,290	52,250	265,000
REQUIRED CAPACITY	1,576	525,400	5,254	52,540	262,700
SURPLUS	537	358,600	36	---	2,300
DEFICIENCY	---	---	---	290	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 5

TABLE 5-4

COMBINED CAPACITY BY SUB-REGION
PROPOSED CONDITIONS TO 2025

Sub Region # 5: Ben Wheeler WSC, Edom WSC, Martins Mill WSC, RPM WSC, Callender Lake Subdivision

Number of Connections: 2,627 (Existing) + 467 (Projected) = 3,094

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Ben Wheeler	775	360,000	1,800	19,000	180,000
Edom	298	148,000	1,300	15,000	---
Martins Mill	63	20,000	150	3,000	---
RPM	440	165,000	600	750	85,000
Callender Lake	537	191,000	1,440	14,500	---
TOTALS	2,113	884,000	5,290	52,250	265,000
REQUIRED CAPACITY	1,856	618,800	6,188	61,880	309,400
SURPLUS	257	265,200	---	---	---
DEFICIENCY	---	---	898	9,630	44,400

Cluster #6, Harrison County

Cluster #6 is located in south Harrison County and consists of six water systems identified for consolidation — Blocker-Crossroads WSC, Elysian Fields WSC, Gill WSC, Old Town WSC, City of Scottsville and Waskom WSC #1. Water supply for the six systems is from the Carrizo-Wilcox and Cypress aquifers. The consolidated system would have 2,090 current connections, growing to 2,633 by 2025. A water demand and supply analysis shows that two systems will have a supply deficit during the planning period of 2010 to 2060. As a consolidated system, a deficit of 25 ac-ft/yr will occur in 2050 and increasing to a deficit of 87 ac-ft/yr by 2060. An average median household income of $34,020 was calculated for the six systems, and the corresponding monthly average water bill at 1.5% of the median household income was estimated as $42.52.

These four water user groups have the option of combining together and continuing to use ground water from the Carrizo-Wilcox/Cypress aquifers as their source of supply. By merging together, the systems would enjoy the benefits of improved technical, financial and managerial capacity. As a consolidated system, two additional wells with a total yield of 129 ac-ft/yr will have to be drilled – which is enough to meet the 87 ac-ft/yr deficit projected in 2060. The necessary capital improvements are estimated to require $2.00 - $3.00 per month per meter, and this cluster would appear to warrant further consideration.

Attachment A – Groundwater worksheet - Cluster #6 - Harrison County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
2	500	120	**129**	$ 334.00	$ 334,000.00	$ 3,340.00	$ 337,340.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
5,000	6	$ 2.23	$ 66,900.00	$ 2,341.50	$ 69,241.50

Total Construction Cost	**$ 406,581.50**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 121,974.45
INTEREST DURING CONSTRUCTION (3%)	$ 12,197.45
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL CAPITAL COST	**$ 560,753.40**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,829 * $ 0.45/ 1,000)	$ 18,921.41
TOTAL ANNUALIZED COST (O & M Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 59,632.11**
WUG Total WMS Cost Per Acre-Foot (TWDB Calculated)	**$ 304.47**

Location Map – Cluster #6

TABLES FOR CLUSTER #6

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-1-A

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Blocker-Crossroads W.S.C

Number of Connections: 362

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	42	130,000	240	1,570	47,000
2	14				
TOTALS	56	130,000	240	1,570	47,000
REQUIRED CAPACITY	217	72,400	724	1,570	5,660
SURPLUS	---	57,600	---	---	41,340
DEFICIENCY	161	---	484	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-2-A

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Blocker-Crossroads W.S.C

Number of Connections: 362 (Existing) + 118 (Proposed) = 480

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	42	130,000	240	1,570	47,000
2	14				
TOTALS	56	130,000	240	1,570	47,000
REQUIRED CAPACITY	288	96,200	962	1,570	40,100
SURPLUS	---	33,800	---	---	6,900
DEFICIENCY	232	---	722	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-1-B

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Elysian Fields W.S.C.

Number of Connections: 271

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	75	125,000	800	8,000	---
2	150				
TOTALS	225	125,000	800	8,000	---
REQUIRED CAPACITY	163	54,200	542	5,420	---
SURPLUS	62	70,800	258	2,580	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-2-B

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Elysian Fields W.S.C.

Number of Connections: 271 (Existing) + 84 (Proposed) = 355

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	75	125,000	800	8,000	---
2	150				
TOTALS	225	125,000	800	8,000	---
REQUIRED CAPACITY	213	71,000	710	7,100	---
SURPLUS	12	54,000	90	900	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-1-C

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Gill W.S.C.

Number of Connections: 835

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	160	200,000	---	---	200,000
2	150				
3	120				
4	150				
TOTALS	580	200,000	---	---	200,000
REQUIRED CAPACITY	501	167,000	1,670	---	83,500
SURPLUS	79	33,000	---	---	116,500
DEFICIENCY	---	---	1,670	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-2-C

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Gill W.S.C.

Number of Connections: 835 (Existing) + 87 (Proposed) = 922

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	160	200,000	---	---	200,000
2	150				
3	120				
4	150				
TOTALS	580	200,000	---	---	200,000
REQUIRED CAPACITY	553	184,400	1,844	---	92,200
SURPLUS	27	15,600	---	---	107,800
DEFICIENCY	---	---	1,844	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-1-D

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Old Town W.S.C.

Number of Connections: 30

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	---	---	45	1,500	---
TOTALS	---	---	45	1,500	---
REQUIRED CAPACITY	18	6,000	60	600	---
SURPLUS	---	---	---	900	---
DEFICIENCY	18	6,000	15	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-2-D

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Old Town W.S.C.

Number of Connections: 30 (Existing) + 0 (Proposed) = 30

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	---	---	45	1,500	---
TOTALS	---	---	45	1,500	---
REQUIRED CAPACITY	18	6,000	60	600	---
SURPLUS	---	---	---	900	---
DEFICIENCY	18	6,000	15	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-1-E

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: City of Scottsville

Number of Connections: 308

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	240	160,000	1,200	10,600	---
TOTALS	240	160,000	1,200	10,600	---
REQUIRED CAPACITY	185	61,600	616	6,160	---
SURPLUS	55	98,400	584	4,440	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-2-E

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: City of Scottsville

Number of Connections: 308 (Existing) + 89 (Proposed) = 397

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	240	160,000	1,200	10,600	---
TOTALS	240	160,000	1,200	10,600	---
REQUIRED CAPACITY	238	79,400	794	7,940	---
SURPLUS	2	80,600	406	2,660	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-1-F

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Waskom Rural W.S.C. #1

Number of Connections: 284

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	110	60,000	800	8,000	---
2	130				
TOTALS	240	60,000	800	8,000	---
REQUIRED CAPACITY	170	56,800	568	5,680	---
SURPLUS	70	3,200	232	2,320	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-2-F

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Waskom Rural W.S.C. #1

Number of Connections: 284 (Existing) + 165 (Proposed) = 449

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	110	60,000	800	8,000	---
2	130				
TOTALS	240	60,000	800	8,000	---
REQUIRED CAPACITY	269	89,800	898	8,980	---
SURPLUS	---	---	---	---	---
DEFICIENCY	29	29,800	98	980	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-3

COMBINED CAPACITY BY SUB-REGION
EXISTING CONDITIONS

Sub Region # 6: Blocker-Crossroads W.S.C., Elysian Fields W.S.C., Gill W.S.C., Old Town W.S.C., City of Scottsville, Waskom Rural W.S.C. #1

Number of Connections: 2,090

WUG	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Blocker-Crossroads	56	130,000	240	1,570	47,000
Elysian Fields	225	125,000	800	8,000	---
Gill	580	200,000	---	---	200,000
Old Town	---	---	45	1,500	---
Scottsville	240	160,000	1,200	10,600	---
Waskom Rural	240	60,000	800	8,000	---
TOTALS	1,341	675,000	3,085	29,670	247,000
REQUIRED CAPACITY	1,254	418,000	4,180	29,670	60,600
SURPLUS	87	257000	---	---	186,400
DEFICIENCY	---	---	1,095	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 6

TABLE 6-4

COMBINED CAPACITY BY SUB-REGION
PROPOSED CONDITIONS TO 2025

Sub Region # 6: Blocker-Crossroads W.S.C., Elysian Fields W.S.C., Gill W.S.C., Old Town W.S.C., City of Scottsville, Waskom Rural W.S.C. #1

Number of Connections: 2,090 (Existing) + 543 (Projected) = 2,633

WUG	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Blocker-Crossroads	56	130,000	240	1,570	47,000
Elysian Fields	225	125,000	800	8,000	---
Gill	580	200,000	---	---	200,000
Old Town	---	---	45	1,500	---
Scottsville	240	160,000	1,200	10,600	---
Waskom Rural	240	60,000	800	8,000	---
TOTALS	1,341	675,000	3,085	29,670	247,000
REQUIRED CAPACITY	1,580	526,600	5,266	29,670	114,950
SURPLUS	---	148,400	---	---	132,050
DEFICIENCY	239	---	2,181	---	---

Cluster #7, Harrison County

Cluster #7 is located in central-eastern Harrison County and consists of eight water systems identified for consolidation — Caddo Lake WSC (282 connections), Cypress Valley WSC (377), Cypress Village (115), Karnack WSC (210), Leigh WSC (404), North Harrison WSC (415), Shadowood Water Co. (90) and Talley WSC (550). Water supply for the eight systems is from the Carrizo-Wilcox and Cypress aquifers. The consolidated system would have 2,443 current connections, growing to 3,200 by 2025. A water demand and supply analysis shows that three systems will have a supply deficit during the planning period of 2010 to 2060. As a consolidated system, a deficit of 52 ac-ft/yr will occur in 2050 and increasing to a deficit of 150 ac-ft/yr by 2060. An average median household income of $33,907 was calculated for the eight systems, and the corresponding monthly average water bill at 1.5% of the median household income was estimated as $42.38.

These eight water user groups have the option of combining together and continuing to use ground water from the Carrizo-Wilcox/Cypress aquifers as their source of supply. By merging together, the systems would enjoy the benefits of improved technical, financial and managerial capacity. As a consolidated system, 3 additional wells with a total yield of 194 ac-ft/yr will have to be drilled – which is enough to meet the 150 ac-ft/yr deficit projected in 2060. The necessary capital improvements for consolidation would require about $3.00 per meter per month, and this cluster would appear to warrant further consideration.

Attachment A – Groundwater worksheet - Cluster #7 - Harrison County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
3	500	120	**194**	$ 334.00	$ 501,000.00	$ 5,010.00	$ 506,010.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
7,500	6	$ 2.23	$ 100,350.00	$ 3,512.25	$ 103,862.25

Total Construction Cost **$ 609,872.25**

Other Capital Costs

ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 182,961.68
INTEREST DURING CONSTRUCTION (3%)	$ 18,296.17
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL CAPITAL COST	**$ 831,130.09**

OPERATION & MAINTENANCE COSTS $ 28,382.12
(Yield (AF/yr) * 325,829 * $ 0.45/ 1,000)

TOTAL ANNUALIZED COST **$ 88,722.16**
(O & M Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))

WUG Total WMS Cost Per Acre-Foot (TWDB Calculated) **$ 301.82**

Location Map – Cluster #7

TABLES FOR CLUSTER #7

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-1-A

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Caddo Lake W.S.C.

Number of Connections: 452

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	70	100,000	600	7,200	---
TOTALS	70	100,000	600	7,200	---
REQUIRED CAPACITY	271	90,400	904	9,040	---
SURPLUS	---	9,600	---	---	---
DEFICIENCY	201	---	304	1,840	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-2-A

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Caddo Lake W.S.C.

Number of Connections: 452 (Existing) + 136 (Proposed) = 588

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	70	100,000	600	7,200	---
TOTALS	70	100,000	600	7,200	---
REQUIRED CAPACITY	353	117,600	1,176	11,760	---
SURPLUS	---	---	---	---	---
DEFICIENCY	283	17,600	576	4,560	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-1-B

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Cypress Valley W.S.C.

Number of Connections: 377

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	108,000	---	---	74,000
2	50				
3	50				
4	150				
TOTALS	350	108,000	---	---	74,000
REQUIRED CAPACITY	226	75,400	754	---	37,700
SURPLUS	124	32,600	---	---	36,300
DEFICIENCY	---	---	754	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-2-B

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Cypress Valley W.S.C.

Number of Connections: 377 (Existing) + 181 (Proposed) = 558

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	100	108,000	---	---	74,000
2	50				
3	50				
4	150				
TOTALS	350	108,000	---	---	74,000
REQUIRED CAPACITY	335	111,600	1,116	---	55,800
SURPLUS	15	---	---	---	18,200
DEFICIENCY	---	3,600	1,116	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-1-C

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Karnack W.S.C.

Number of Connections: 222

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	226	50,000	---	---	50,000
TOTALS	226	50,000	---	---	50,000
REQUIRED CAPACITY	133	44,400	444	---	22,200
SURPLUS	93	5,600	---	---	27,800
DEFICIENCY	---	---	444	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-2-C

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Karnack W.S.C.

Number of Connections: 222 (Existing) + 0 (Proposed) = 222

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	226	50,000	---	---	50,000
TOTALS	226	50,000	---	---	50,000
REQUIRED CAPACITY	133	44,400	444	---	22,200
SURPLUS	93	5,600	---	---	27,800
DEFICIENCY	---	---	444	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-1-D

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Leigh W.S.C.

Number of Connections: 404

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	75	163,000	468	5,500	25,000
2	85				
3	130				
TOTALS	290	163,000	468	5,500	25,000
REQUIRED CAPACITY	242	80,000	808	5,500	12,900
SURPLUS	48	83,000	---	---	12,100
DEFICIENCY	---	---	340	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-2-D

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Leigh W.S.C.

Number of Connections: 404 (Existing) + 120 (Proposed) = 524

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	75	163,000	468	5,500	25,000
2	85				
3	130				
TOTALS	290	163,000	468	5,500	25,000
REQUIRED CAPACITY	314	104,800	1,048	5,500	24,900
SURPLUS	---	58,200	---	---	100
DEFICIENCY	24	---	580	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-1-E

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: North Harrison W.S.C.

Number of Connections: 415

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	130	150,000	500	5,000	66,000
2	115				
3	100				
TOTALS	345	150,000	500	5,000	6,600
REQUIRED CAPACITY	249	83,000	830	5,000	16,500
SURPLUS	96	67,000	---	---	49,500
DEFICIENCY	---	---	330	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-2-E

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: North Harrison W.S.C.

Number of Connections: 415 (Existing) + 200 (Proposed) = 615

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	130	150,000	500	5,000	66,000
2	115				
3	100				
TOTALS	345	150,000	500	5,000	66,000
REQUIRED CAPACITY	369	123,000	1,230	5,000	36,500
SURPLUS	---	27,000	---	---	29,500
DEFICIENCY	24	---	730	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-1-F

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Shadowood W.S.C.

Number of Connections: 90

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	70	43,000	720	3,000	---
2	30				
TOTALS	100	43,000	720	3,000	---
REQUIRED CAPACITY	54	18,000	180	1,800	---
SURPLUS	66	25,000	540	1,200	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-2-F

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Shadowood W.S.C.

Number of Connections: 90 (Existing) + 30 (Proposed) = 120

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	70	43,000	720	3,000	---
2	30				
TOTALS	100	43,000	720	3,000	---
REQUIRED CAPACITY	72	24,000	240	2,400	---
SURPLUS	28	19,000	480	600	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-1-G

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Talley W.S.C.

Number of Connections: 550

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	220	250,000	1,440	10,000	---
TOTALS	220	250,000	1,440	10,000	---
REQUIRED CAPACITY	330	110,000	1,100	11,000	---
SURPLUS	---	140,000	340	---	---
DEFICIENCY	110	---	---	1,000	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-2-G

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Talley W.S.C.

Number of Connections: 550 (Existing) + 117 (Proposed) = 667

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	220	250,000	1,440	10,000	---
TOTALS	220	250,000	1,440	10,000	---
REQUIRED CAPACITY	400	133,400	1,334	13,340	---
SURPLUS	---	116,600	106	---	---
DEFICIENCY	180	---	---	3,340	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-1-H

CAPACITY BY WUG
EXISTING CONDITIONS

WUG Name: Cypress Village

Number of Connections: 115

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	70	42,000	720	3,000	---
TOTALS	70	42,000	720	3,000	---
REQUIRED CAPACITY	69	23,000	230	2,300	---
SURPLUS	1	19,000	490	700	---
DEFICIENCY		---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-2-H

CAPACITY BY WUG
PROPOSED CONDITIONS TO 2025

WUG Name: Cypress Village

Number of Connections: 115 (Existing) + 36 (Proposed) = 151

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	70	42,000	720	3,000	---
TOTALS	70	42,000	720	3,000	---
REQUIRED CAPACITY	91	30,200	302	3,020	---
SURPLUS	---	11,800	418	---	---
DEFICIENCY	21	---	---	20	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-3

COMBINED CAPACITY BY SUB-REGION
EXISTING CONDITIONS

Sub Region # 7: Caddo Lake W.S.C., Cypress Valley W.S.C.,Karnack W.S.C., Leigh W.S.C., North Harrison W.S.C., Shadowood W.S.C., Talley W.S.C., Cypress Village

Number of Connections: 2,443

WUG	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Caddo Lake	70	100,000	600	7,200	---
Cypress Valley	350	108,000	---	---	74,000
Karnack	226	50,000	---	---	50,000
Leigh	290	163,000	468	5,500	25,000
North Harrison	105	150,000	500	5,000	66,000
Shadowood	100	43,000	720	3,000	---
Talley	220	250,000	1440	10,000	---
Cypress Village	70	42,000	720	3,000	---
TOTALS	1,431	906,000	4,448	33,700	215,000
REQUIRED CAPACITY	1,466	488,600	4,886	34,640	95,500
SURPLUS	---	417,400	---	---	119,500
DEFICIENCY	35	---	438	940	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 7

TABLE 7-4

COMBINED CAPACITY BY SUB-REGION
PROPOSED CONDITIONS TO 2025

Sub Region # 7: Caddo Lake W.S.C., Cypress Valley W.S.C.,Karnack W.S.C., Leigh W.S.C., North Harrison W.S.C., Shadowood W.S.C., Talley W.S.C., Cypress Village

Number of Connections: 2,443 (Existing) + 757 (Projected) = 3,200

WUG	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Caddo Lake	70	100,000	600	7,200	---
Cypress Valley	350	108,000	---	---	74,000
Karnack	226	50,000	---	---	50,000
Leigh	290	163,000	468	5,500	25,000
North Harrison	105	150,000	500	5,000	66,000
Shadowood	100	43,000	720	3,000	---
Talley	220	250,000	1440	10,000	---
Cypress Valley	70	42,000	720	3,000	---
TOTALS	1,431	906,000	4,448	33,700	215,000
REQUIRED CAPACITY	1,920	640,000	6,400	42,220	175,900
SURPLUS	---	266,000	---	---	39,100
DEFICIENCY	489	---	1,952	8,520	---

Cluster #8, Upshur County

Cluster #8 is located in southern Upshur County and northern Gregg County and consists of five water systems identified for consolidation — City of Clarksville City (318 connections), City of East Mountain (600), Glenwood WSC (857), Union Grove WSC (830) and City of Warren City (126). Water supply for the five systems is from the Carrizo-Wilcox and Lake Gladewater. The consolidated system would have 2,731 current connections, growing to 3,367 by 2025. A water demand and supply analysis shows that each system will have a supply surplus during the planning period of 2010 to 2060. An average median household income of $35,383 was calculated for the five systems, and the corresponding monthly average water bill at 1.5% of the median household income was estimated as $44.23.

These five water user groups have the option of combining together and continuing to use ground water from the Carrizo-Wilcox and surface water from Lake Gladewater as their source of supply. By merging together, the systems would enjoy the benefits of improved technical, financial and managerial capacity. No capital improvements are required.

Location Map – Cluster #8

TABLES FOR CLUSTER #8

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-1-A

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: City of Clarksville City

Number of Connections: 318

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	---	465,000	1,000	---	147,000
TOTALS	---	465,000	1,000	---	147,000
REQUIRED CAPACITY	191	63,600	636	---	31,800
SURPLUS	---	401,400	364	---	115,200
DEFICIENCY	191	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-2-A

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: City of Clarksville City

Number of Connections: 318 (Existing) + 86 (Proposed) = 404

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	---	465,000	1,000	---	147,000
TOTALS	---	465,000	1,000	---	147,000
REQUIRED CAPACITY	242	81,800	818	---	40,400
SURPLUS	---	383,200	182	---	106,600
DEFICIENCY	242	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-1-B

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: City of East Mountain

Number of Connections: 600

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	325	450,000	750	---	200,000
2	150				
3	110				
4	100				
TOTALS	685	450,000	750	---	200,000
REQUIRED CAPACITY	360	120,000	1,200	---	60,000
SURPLUS	325	330,000	---	---	140,000
DEFICIENCY	---	---	450	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-2-B

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: City of East Mountain

Number of Connections: 600 (Existing) + 104 (Proposed) = 704

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	325	450,000	750	---	200,000
2	150				
3	110				
4	100				
TOTALS	685	450,000	750	---	200,000
REQUIRED CAPACITY	422	140,800	1,408	---	70,400
SURPLUS	263	309,200	---	---	129,600
DEFICIENCY	---	---	658	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-1-C

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Glenwood W.S.C.

Number of Connections: 857

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	75	165,000	2,000	11,800	65,000
2	75				
3	110				
4	65				
5	135				
6	260				
TOTALS	720	165,000	2,000	11,800	65,000
REQUIRED CAPACITY	514	171,400	1,714	11,800	28,500
SURPLUS	206	---	286	---	36,500
DEFICIENCY	---	6,400	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-2-C

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Glenwood W.S.C.

Number of Connections: 857 (Existing) + 282 (Proposed) = 1,139

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	75	165,000	2,000	11,800	65,000
2	75				
3	110				
4	65				
5	135				
6	260				
TOTALS	720	165,000	2,000	11,800	65,000
REQUIRED CAPACITY	683	227,800	2,278	11,800	54,900
SURPLUS	37	---	---	---	10,100
DEFICIENCY	---	62,800	278	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-1-D

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Union Grove W.S.C.

Number of Connections: 830

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	843	235,000	1,640	---	100,000
TOTALS	843	235,000	1,640	---	100,000
REQUIRED CAPACITY	498	166,000	1,660	---	83,000
SURPLUS	345	69,000	---	---	17,000
DEFICIENCY	---	---	20	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-2-D

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Union Grove W.S.C.

Number of Connections: 830 (Existing) + 149 (Proposed) = 979

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	843	235,000	1,640	---	100,000
TOTALS	843	235,000	1,640	---	100,000
REQUIRED CAPACITY	587	195,800	1,958	---	97,900
SURPLUS	256	39,200	---	---	2,100
DEFICIENCY	---	---	318	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-1-E

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: City of Warren City

Number of Connections: 126

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	--	50,000	1,000	5,000	--
TOTALS	--	50,000	1,000	5,000	--
REQUIRED CAPACITY	77	25,200	252	2,520	---
SURPLUS	---	24,800	748	2,480	---
DEFICIENCY	77	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-2-E

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: City of Warren City

Number of Connections: 126 (Existing) + 15 (Proposed) = 141

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	--	50,000	1,000	5,000	--
TOTALS	--	50,000	1,000	5,000	--
REQUIRED CAPACITY	85	28,200	282	2,820	---
SURPLUS	---	21,800	718	2,180	---
DEFICIENCY	85	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-3

COMBINED CAPACITY BY SUB-REGION
EXISTING CONDITIONS

Sub Region # 8: City of Clarksville City, Glenwood W.S.C., City of East Mountain, Union Grove W.S.C., City of Warren City

Number of Connections: 2,731

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Clarksville City	---	465,000	1,000	---	147,000
East Mountain	685	450,000	750	---	200,000
Glenwood	720	165,000	2,000	11,800	65,000
Union Grove	843	235,000	1,640	---	100,000
Warren City	---	50,000	1,000	5,000	---
TOTALS	2,248	1,365,000	6,390	16,800	512,000
REQUIRED CAPACITY	1,639	546,200	5,462	16,800	189,100
SURPLUS	609	818,800	928	---	322,900
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 8

TABLE 8-4

COMBINED CAPACITY BY SUB-REGION
PROPOSED CONDITIONS TO 2025

Sub Region # 8: City of Clarksville City, Glenwood W.S.C., City of East Mountain, Union Grove W.S.C., City of Warren City

Number of Connections: 2,731 (Existing) + 636 (Projected) = 3,367

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Clarksville City	---	465,000	1,000	---	147,000
East Mountain	685	450,000	750	---	200,000
Glenwood	720	165,000	2,000	11,800	65,000
Union Grove	843	235,000	1,640	---	100,000
Warren City	---	50,000	1,000	5,000	---
TOTALS	2,248	1,365,000	6,390	16,800	512,000
REQUIRED CAPACITY	2,020	673,400	6,734	16,800	252,700
SURPLUS	228	691,600	---	---	259,300
DEFICIENCY	---	---	344	---	---

Cluster #9, Smith County

Cluster #9 is located in northeastern Smith County and consists of three water systems identified for consolidation — Star Mountain WSC (504 connections), Starrville-Friendship WSC (509) and Starville WSC (239). Water supply for the three systems is from the Carrizo-Wilcox and Lake Gladewater. The consolidated system would have 1,273 current connections, growing to 1,993 by 2025. A water demand and supply analysis shows that two systems will have a supply deficit during the planning period of 2010 to 2060. As a consolidated system, a deficit of 47 ac-ft/yr will occur in 2050 and increasing to a deficit of 102 ac-ft/yr by 2060. An average median household income of $33,131 was calculated for the three systems, and the corresponding monthly average water bill at 1.5% of the median household income was estimated as $41.41.

These three water user groups have the option of combining together and continuing to use ground water from the Carrizo-Wilcox and surface water from Lake Gladewater as their source of supply. By merging together, the systems would enjoy the benefits of improved technical, financial and managerial capacity. As a consolidated system, 1 additional well with a total yield of 108 ac-ft/yr will have to be drilled – which is enough to meet the 102 ac-ft/yr deficit projected in 2060. Without consolidation the two systems with shortages would likely drill duplicate wells.

Attachment A – Groundwater worksheet - Cluster #9 - Smith County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
1	600	200	**108**	$ 334.00	$ 200,400.00	$ 2,004.00	$ 202,404.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
2,500	6	$ 2.23	$ 33,450.00	$ 1,170.75	$ 34,620.75

Total Construction Cost	**$ 237,024.75**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 71,107.43
INTEREST DURING CONSTRUCTION (3%)	$ 7,110.74
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL CAPITAL COST	**$ 335,242.92**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,829 * $ 0.45/ 1,000)	$ 15,767.84
TOTAL ANNUALIZED COST (O & M Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 40,106.48**
WUG Total WMS Cost Per Acre-Foot (TWDB Calculated)	**$ 258.68**

Location Map – Cluster #9

TABLES FOR CLUSTER #9

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 9

TABLE 9-1-A

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Starrville-Friendship W.S.C.

Number of Connections: 530

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	385	340,000	1,050	11,000	30,000
TOTALS	385	340,000	1,050	11,000	30,000
REQUIRED CAPACITY	318	106,000	1,060	10,600	---
SURPLUS	67	234,000	---	400	30,000
DEFICIENCY	---	---	10	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 9

TABLE 9-2-A

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Starrville-Friendship W.S.C.

Number of Connections: 530 (Existing) + 300 (Proposed) = 830

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	385	340,000	1,050	11,000	30,000
TOTALS	385	340,000	1,050	11,000	30,000
REQUIRED CAPACITY	498	166,000	1,660	11,000	28,000
SURPLUS	---	238,200	---	---	2,000
DEFICIENCY	113	---	610	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 9

TABLE 9-1-B

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Star Mountain W.S.C.

Number of Connections: 504

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	210	110,000	670	7,500	---
TOTALS	210	110,000	670	7,500	---
REQUIRED CAPACITY	302	100,800	1,008	10,080	---
SURPLUS	---	9,200	---	---	---
DEFICIENCY	92	---	338	2,580	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 9

TABLE 9-2-B

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Star Mountain W.S.C.

Number of Connections: 504 (Existing) + 180 (Proposed) = 684

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	210	110,000	670	7,500	---
TOTALS	210	110,000	670	7,500	---
REQUIRED CAPACITY	410	136,800	1,368	13,680	---
SURPLUS	---	---	---	---	---
DEFICIENCY	200	26,800	698	6,180	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 9

TABLE 9-1-C

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Starrville W.S.C.

Number of Connections: 239

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	150	115,000	---	---	36,000
TOTALS	150	115,000	---	---	36,000
REQUIRED CAPACITY	143	47,800	478	---	23,900
SURPLUS	7	67,200	---	---	12,100
DEFICIENCY	---	---	478	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 9

TABLE 9-2-C

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Starrville W.S.C.

Number of Connections: 239 (Existing) + 240 (Proposed) = 479

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	150	115,000	---	---	36,000
TOTALS	150	115,000	---	---	36,000
REQUIRED CAPACITY	287	95,800	958	---	47,900
SURPLUS	---	19,200	---	---	---
DEFICIENCY	137	---	958	---	11,900

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 9

TABLE 9-3

COMBINED CAPACITY BY SUB-REGION
EXISTING CONDITIONS

Sub Region # 9: Starrville-Friendship W.S.C., Star Mountain W.S.C., Starrville W.S.C.

Number of Connections: 1,273

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Starrville-Friendship	385	340,000	1,050	11,000	30,000
Star Mountain	210	110,000	670	7,500	---
Starrville	150	115,000	---	---	36,000
TOTALS	720	165,000	2,000	11,800	65,000
REQUIRED CAPACITY	764	254,600	2,546	11,800	68,300
SURPLUS	---	---	---	---	---
DEFICIENCY	44	89,600	546	---	3,300

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 9

TABLE 9-4

COMBINED CAPACITY BY SUB-REGION
PROPOSED CONDITIONS TO 2025

Sub Region # 9: Starrville-Friendship W.S.C., Star Mountain W.S.C., Starrville W.S.C.

Number of Connections: 1,273 (Existing) + 720 (Proposed) = 1,993

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Starrville-Friendship	385	340,000	1,050	11,000	30,000
Star Mountain	210	110,000	670	7,500	---
Starrville	150	115,000	---	---	36,000
TOTALS	720	165,000	2,000	11,800	65,000
REQUIRED CAPACITY	1,196	398,600	3,986	11,800	140,300
SURPLUS	---	---	---	---	---
DEFICIENCY	476	233,600	1,986	---	75,300

Cluster #10, Smith County

Cluster #10 is located in northwestern Smith County and consists of four water systems identified for consolidation — Duck Creek WSC (697 connections), Enchanted Lakes Water Co. (161), Lindale Rural WSC (2300) and Pine Ridge WSC (493). Water supply for the four systems is from the Carrizo-Wilcox. The consolidated system would have 3,651 current connections, growing to 4,581 by 2025. A water demand and supply analysis shows that one system will have a supply deficit during the planning period of 2010 to 2060. However, as a consolidated system, the clusters will have a water surplus during the planning period. An average median household income of $36,651 was calculated for the six systems, and the corresponding monthly average water bill at 1.5% of the median household income was estimated as $45.81.

These four water user groups have the option of combining together and continuing to use ground water from the Carrizo-Wilcox as their source of supply. By merging together, the systems would enjoy the benefits of improved technical, financial and managerial capacity. While the combined system would have surplus supply, the supply and demand are geographically separate, and an additional well would likely be required in the Lindale Rural service area.

Attachment A – Surface Water worksheet - Cluster #10 - Smith County

CAPITAL COST

Construction

Well

No of wells	Depth (ft)	Yield per well (gpm)	Total Yield (AF)	Unit Cost / VF	Well subtotal const cost	Land & easements (1%)	Subtotal
2	600	200	**215**	$ 334.00	$ 400,800.00	$ 4,008.00	$ 404,808.00

Raw Water Main

Length (ft)	Diam (in)	Unit Cost ($ / in / ft)	Total Cost	Land & Easements (3.5%)	Subtotal
5,000	6	$ 2.23	$ 66,900.00	$ 2,341.50	$ 69,241.50

Total Construction Cost	**$ 474,049.50**
Other Capital Costs	
ADMINISTRATION, ENGINEERING, LEGAL, CONTINGENCIES (30%)	$ 142,214.85
INTEREST DURING CONSTRUCTION (3%)	$ 14,221.49
ENVIRONMENTAL (LUMP SUM)	$ 20,000.00
TOTAL CAPITAL COST	**$ 650,485.84**
OPERATION & MAINTENANCE COSTS (Yield (AF/yr) * 325,829 * $ 0.45/ 1,000)	$ 31,535.69
TOTAL ANNUALIZED COST (O & M Cost + Total Capital Cost * debt service factor (30 yrs @ 6%))	**$ 78,760.96**
WUG Total WMS Cost Per Acre-Foot (TWDB Calculated)	**$ 256.50**

Location Map – Cluster #10

TABLES FOR CLUSTER #10

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 10

TABLE 10-1-A

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Duck Creek W.S.C.

Number of Connections: 697

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	228	178,000	680	2,500	41,000
TOTALS	228	178,000	680	2,500	41,000
REQUIRED CAPACITY	418	139,400	1,394	2,500	57,200
SURPLUS	---	38,600	---	---	---
DEFICIENCY	190	---	714	---	16,200

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 10

TABLE 10-2-A

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Duck Creek W.S.C.

Number of Connections: 697 (Existing) + 10 (Proposed) = 707

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	228	178,000	680	2,500	41,000
TOTALS	228	178,000	680	2,500	41,000
REQUIRED CAPACITY	424	141,400	1,414	2,500	58,200
SURPLUS	---	36,600	---	---	---
DEFICIENCY	196	---	734	---	17,200

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 10

TABLE 10-1-B

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Enchanted Lakes Water Co.

Number of Connections: 161

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	348				
TOTALS	348				
REQUIRED CAPACITY	97				
SURPLUS	251	---	---	---	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 10

TABLE 10-2-B

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Enchanted Lakes Water Co.

Number of Connections: 161 (Existing) + 0 (Proposed) = 161

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	348				
TOTALS	348				
REQUIRED CAPACITY	97				
SURPLUS	251	---	---	---	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 10

TABLE 10-1-C

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Lindale Rural W.S.C.

Number of Connections: 2300

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	280	849,000	2,400	15,000	419,000
2	265				
3	220				
4	1,000				
5	280				
TOTALS	2,045	849,000	2,400	15,000	419,000
REQUIRED CAPACITY	1,380	460,000	4,600	15,000	155,000
SURPLUS	665	389,000	---	---	264,000
DEFICIENCY	---	---	2,200	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 10

TABLE 10-2-C

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Lindale Rural W.S.C.

Number of Connections: 2300 (Existing) + 787 (Proposed) = 3,087

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	280	849,000	2,400	15,000	419,000
2	265				
3	220				
4	1,000				
5	280				
TOTALS	2,045	849,000	2,400	15,000	419,000
REQUIRED CAPACITY	1,852	617,400	6,174	15,000	233,700
SURPLUS	193	231,600	---	---	185,300
DEFICIENCY	---	---	3,774	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 10

TABLE 10-1-D

CAPACITY BY WUG

EXISTING CONDITIONS

WUG Name: Pine Ridge W.S.C.

Number of Connections: 493

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	397	111,000	1,219	11,000	---
TOTALS	397	111,000	1,219	11,000	---
REQUIRED CAPACITY	296	98,600	986	9,860	
SURPLUS	101	12,400	233	1,140	---
DEFICIENCY	---	---	---	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 10

TABLE 10-2-D

CAPACITY BY WUG

PROPOSED CONDITIONS TO 2025

WUG Name: Pine Ridge W.S.C.

Number of Connections: 493 (Existing) + 133 (Proposed) = 626

WELL #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
1	397	111,000	1,219	11,000	---
TOTALS	397	111,000	1,219	11,000	---
REQUIRED CAPACITY	376	125,200	1,252	12,520	
SURPLUS	21	---	---	---	---
DEFICIENCY	---	14,200	33	1,520	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 10

TABLE 10-3

COMBINED CAPACITY BY SUB-REGION
EXISTING CONDITIONS

Sub Region # 10: Duck Creek W.S.C., Enchanted Lakes Water Co., Lindale Rural W.S.C., Pine Ridge W.S.C.

Number of Connections: 3,651

WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Duck Creek	228	178,000	680	2,500	41,000
Enchanted Lakes	348				
Lindale Rural	2,045	849,000	2,400	15,000	419,000
Pine Ridge	397	111,000	1,219	11,000	---
TOTALS	3,018	1,138,000	4,299	28,500	460,000
REQUIRED CAPACITY	2,191	730,200	7,302	28,500	222,600
SURPLUS	827	407,800	---	---	237,400
DEFICIENCY	---	---	3,003	---	---

NORTH EAST TEXAS 2006 REGIONAL WATER PLAN
SUB-REGIONAL WATER SUPPLY MASTER PLANS
SUB-REGION # 10

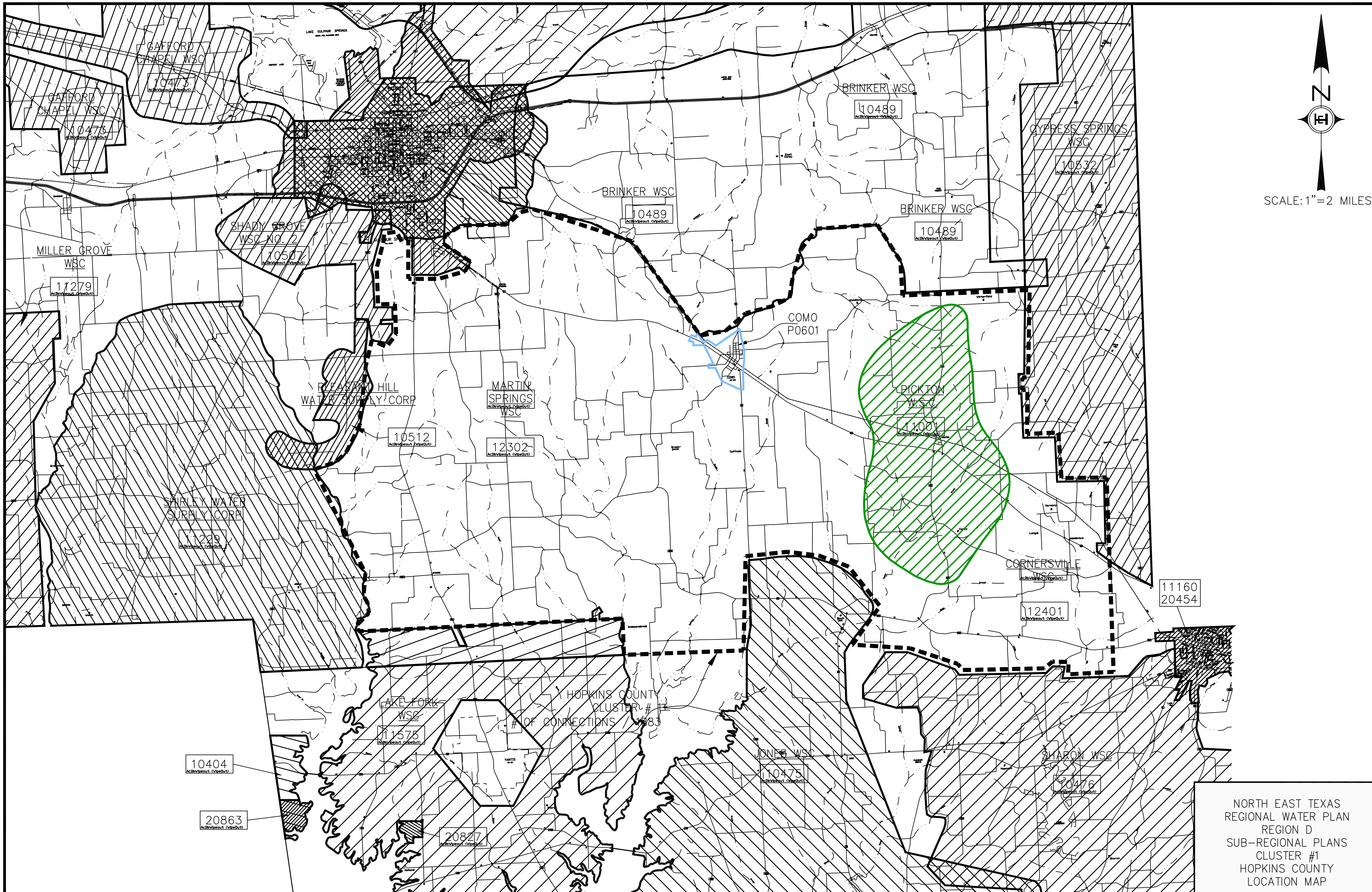
TABLE 10-4

COMBINED CAPACITY BY SUB-REGION
PROPOSED CONDITIONS TO 2025

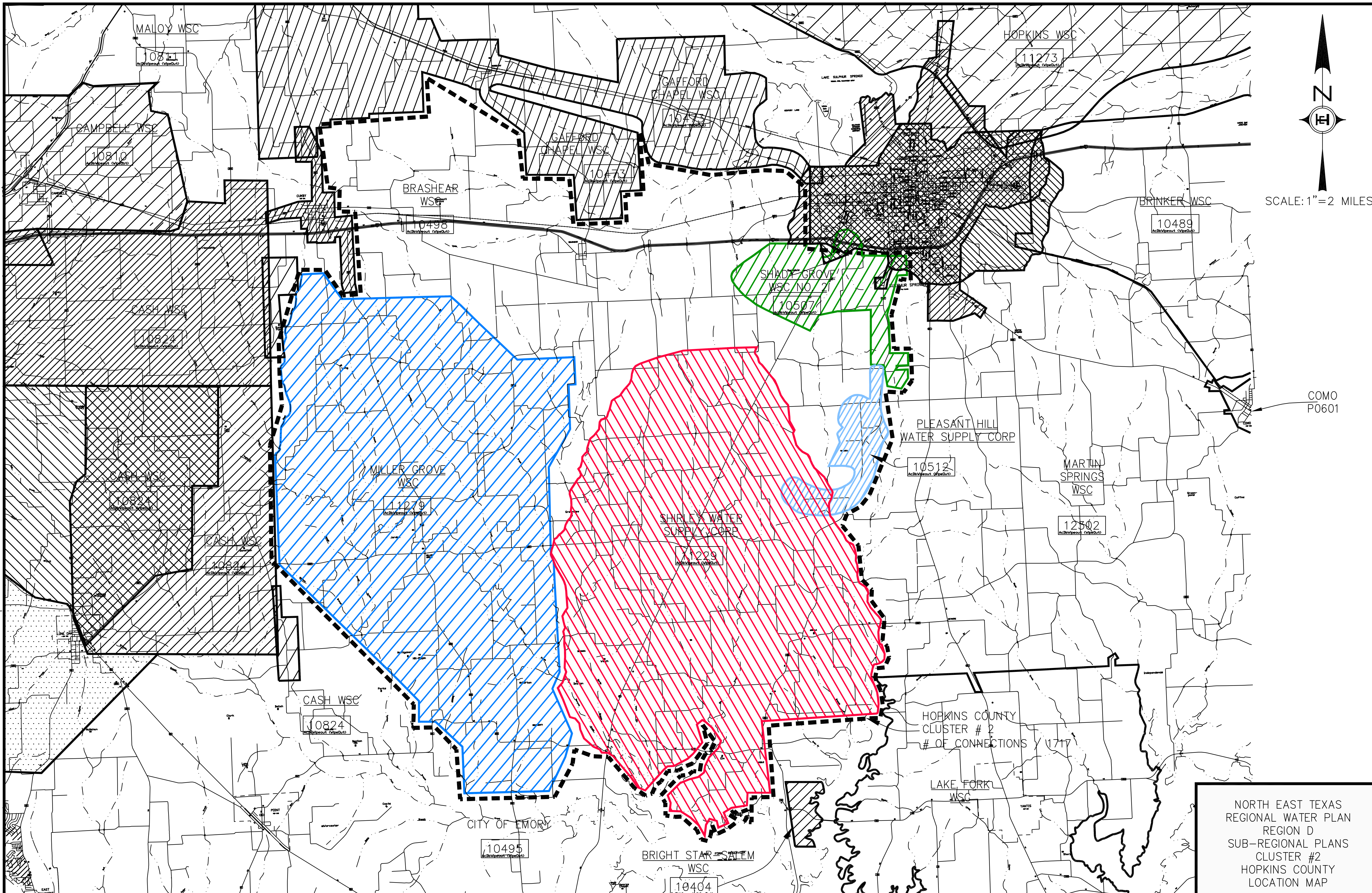
Sub Region # 10: Duck Creek W.S.C., Enchanted Lakes Water Co., Lindale Rural W.S.C., Pine Ridge W.S.C.

Number of Connections: 3,651 (Existing) + 930 (Proposed) = 4,581

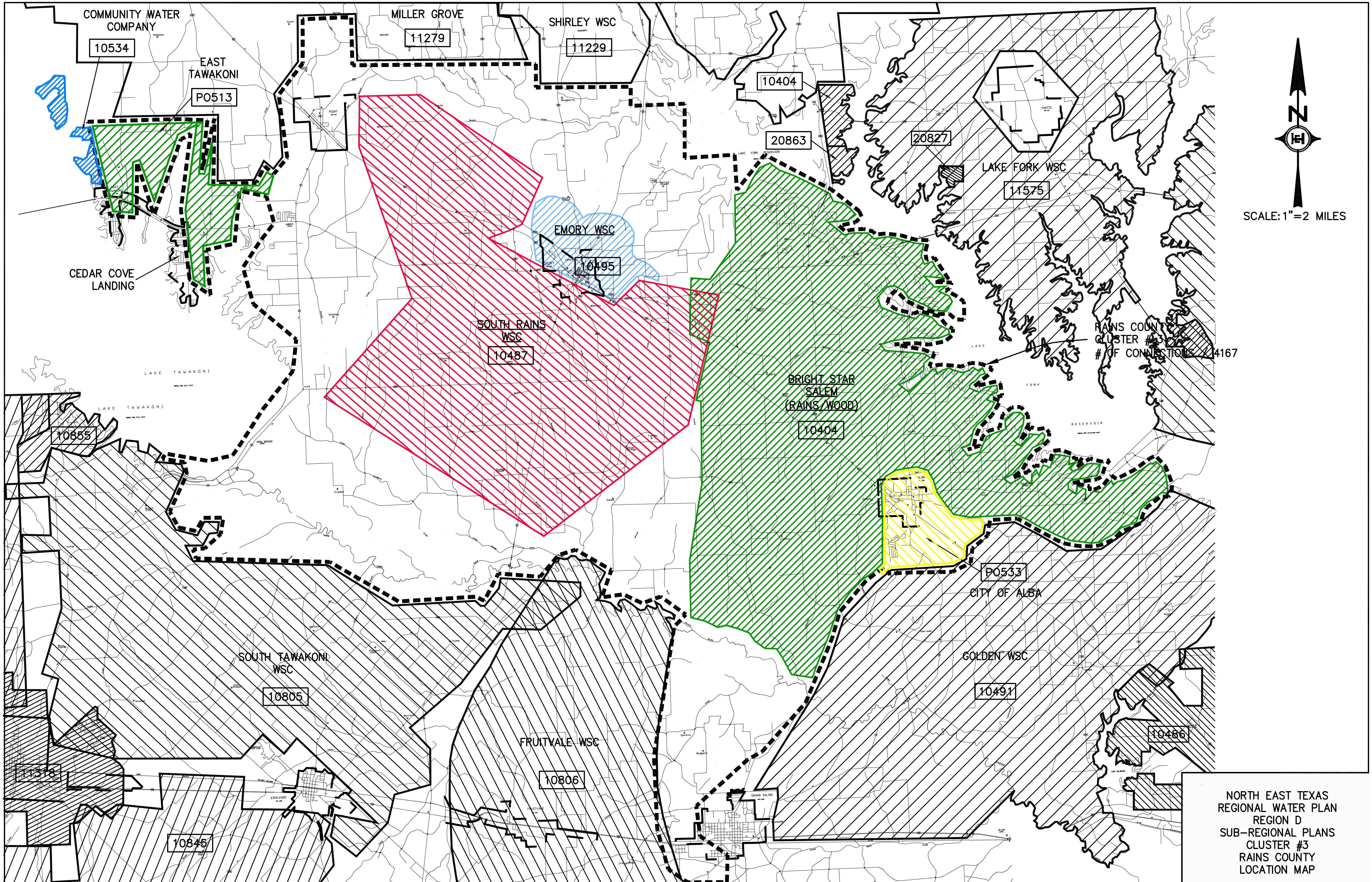
WUG #	SUPPLY (GPM)	TOTAL STORAGE (GALS)	PUMPING (GPM)	PRESSURE TANK (GALS)	ELEVATED STORAGE (GALS)
Duck Creek	228	178,000	680	2,500	41,000
Enchanted Lakes	348				
Lindale Rural	2,045	849,000	2,400	15,000	419,000
Pine Ridge	397	111,000	1,219	11,000	---
TOTALS	3,018	1,138,000	4,299	28,500	460,000
REQUIRED CAPACITY	2,749	916,200	9,162	28,500	315,600
SURPLUS	269	221,800	---	---	144,400
DEFICIENCY	---	---	4,863	---	---



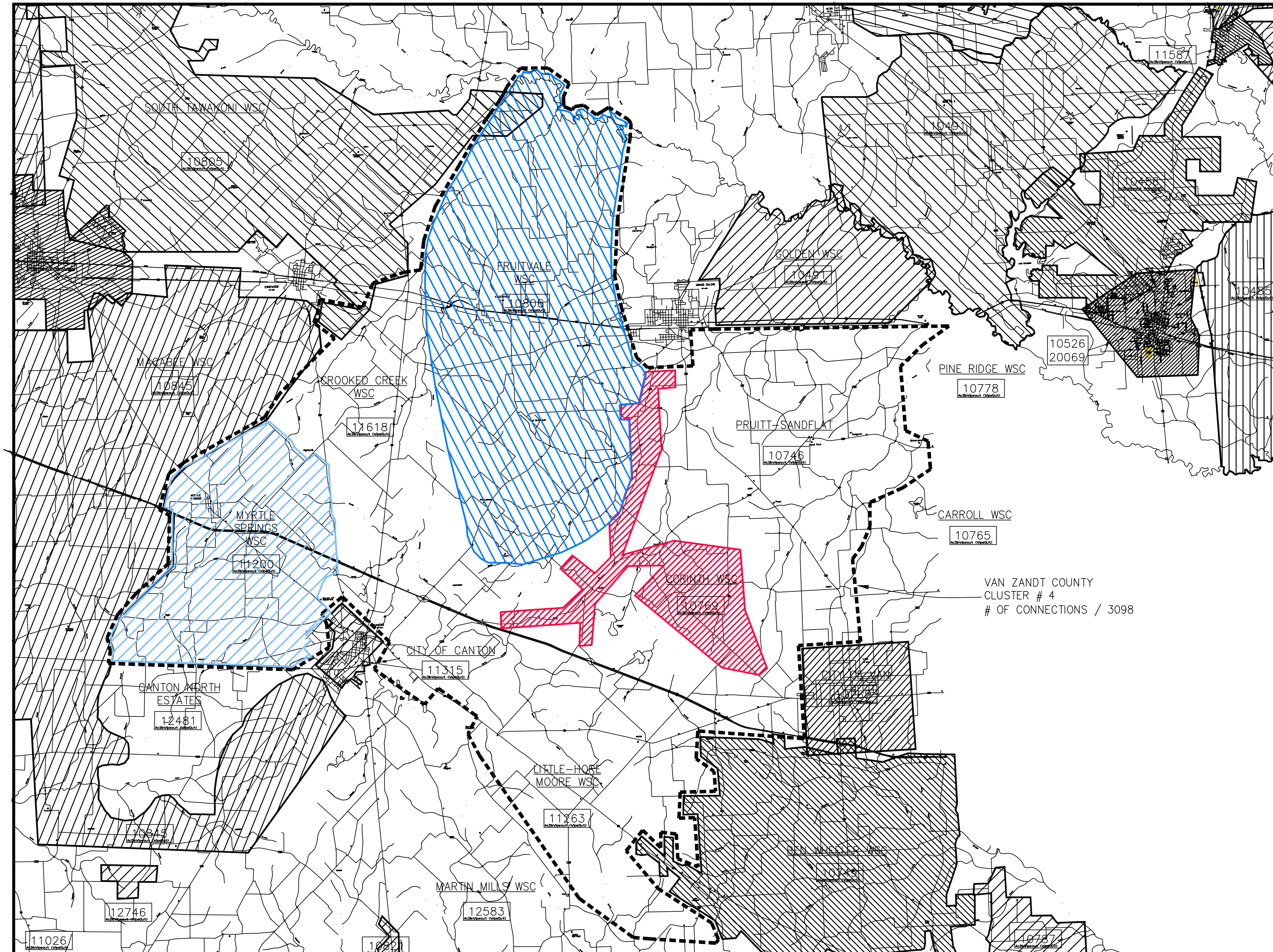
NORTH EAST TEXAS
REGIONAL WATER PLAN
REGION D
SUB-REGIONAL PLANS
CLUSTER #1
HOPKINS COUNTY
LOCATION MAP



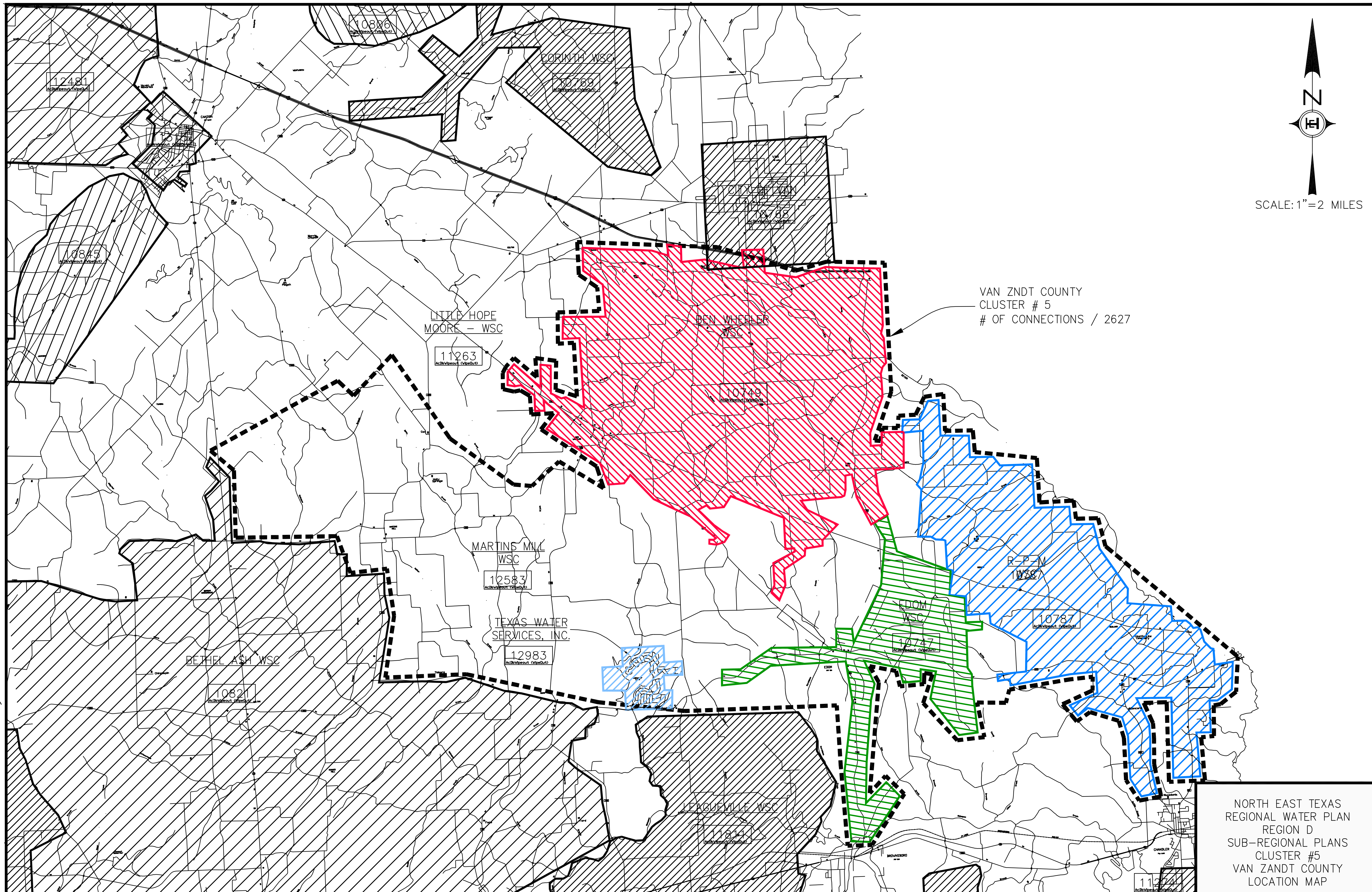
NORTH EAST TEXAS
REGIONAL WATER PLAN
REGION D
SUB-REGIONAL PLANS
CLUSTER #2
HOPKINS COUNTY
LOCATION MAP



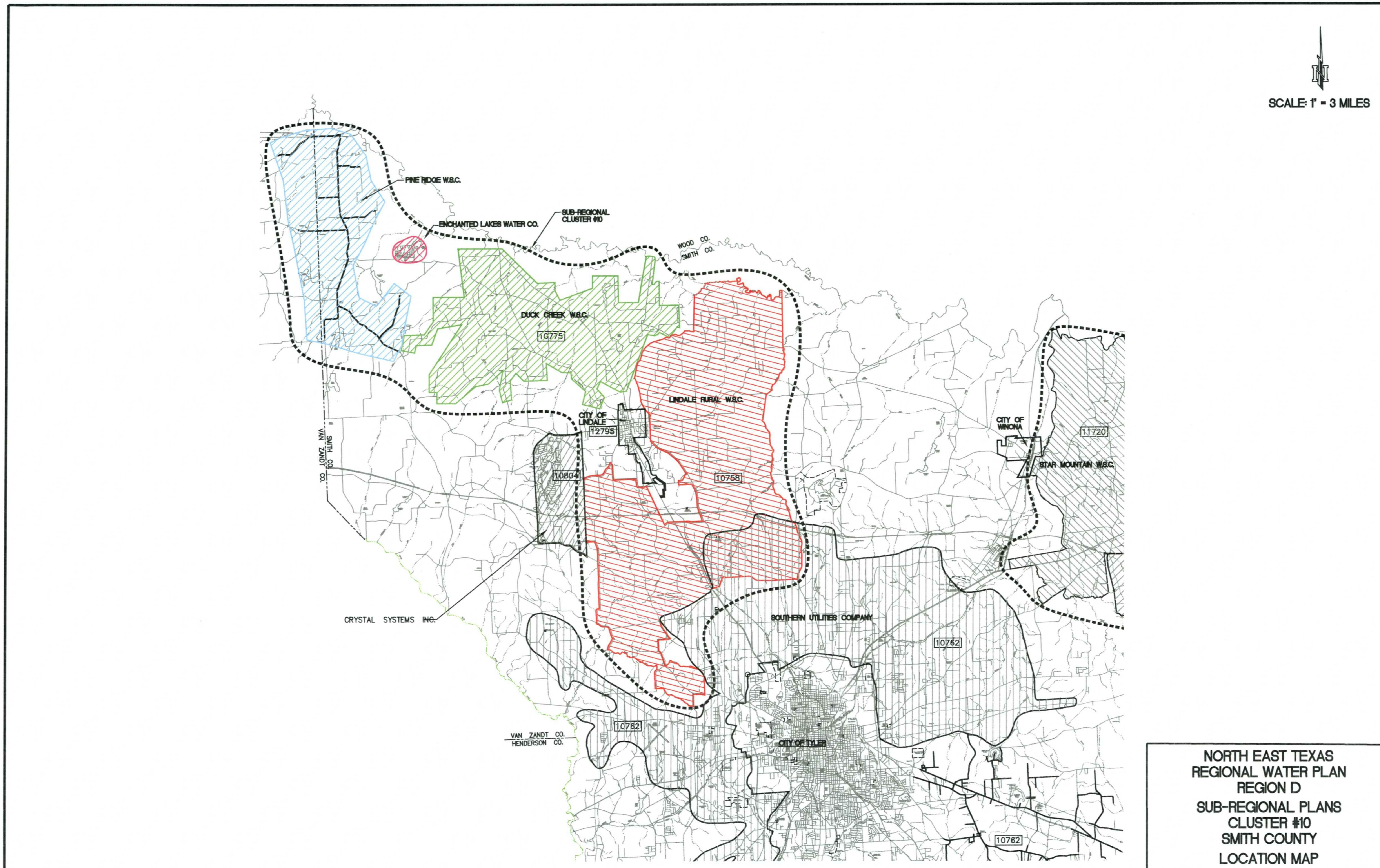
NORTH EAST TEXAS
REGIONAL WATER PLAN
REGION D
SUB-REGIONAL PLANS
CLUSTER #3
RAINS COUNTY
LOCATION MAP



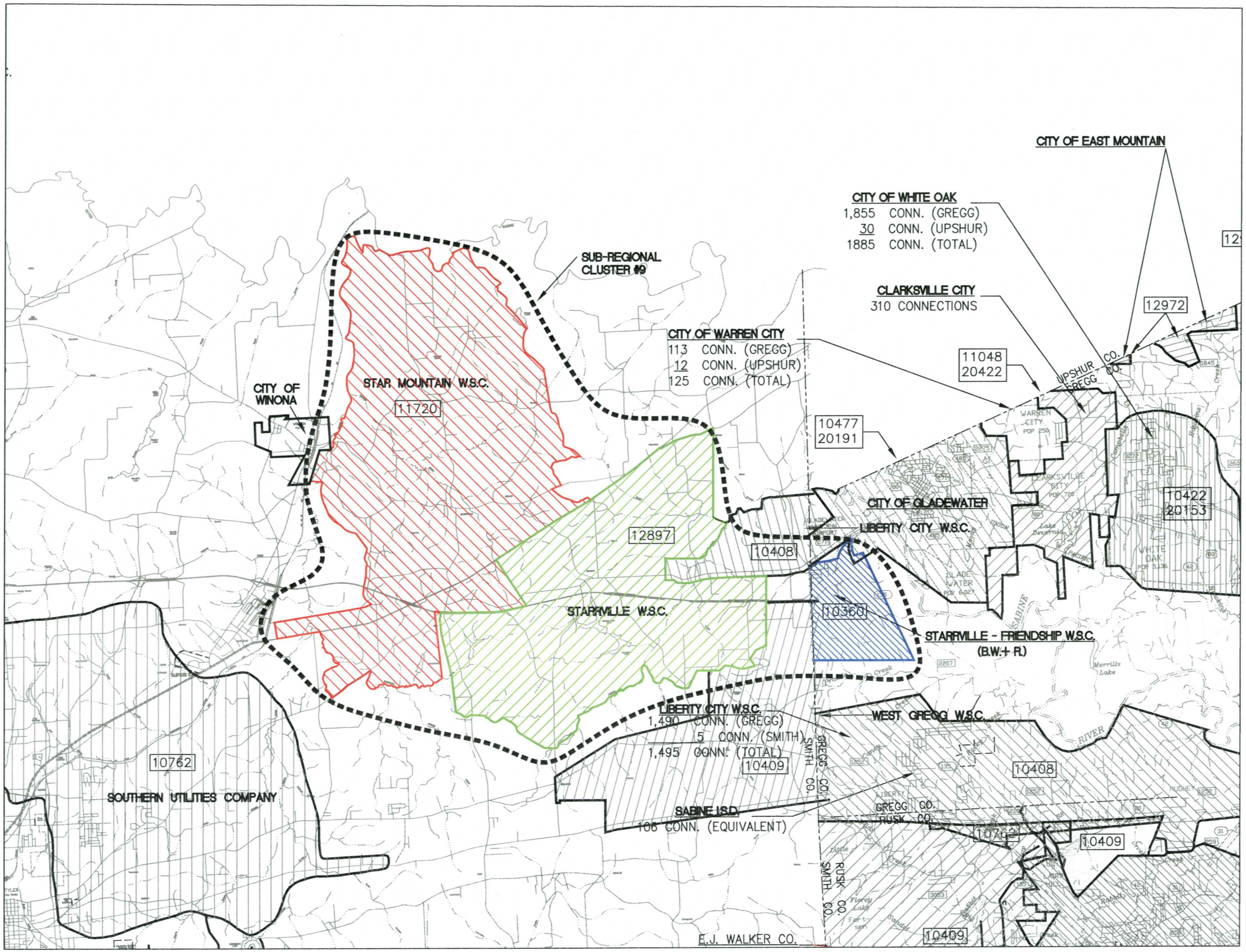
NORTH EAST TEXAS
REGIONAL WATER PLAN
REGION D
SUB-REGIONAL PLANS
CLUSTER #4
VAN ZANDT COUNTY
LOCATION MAP



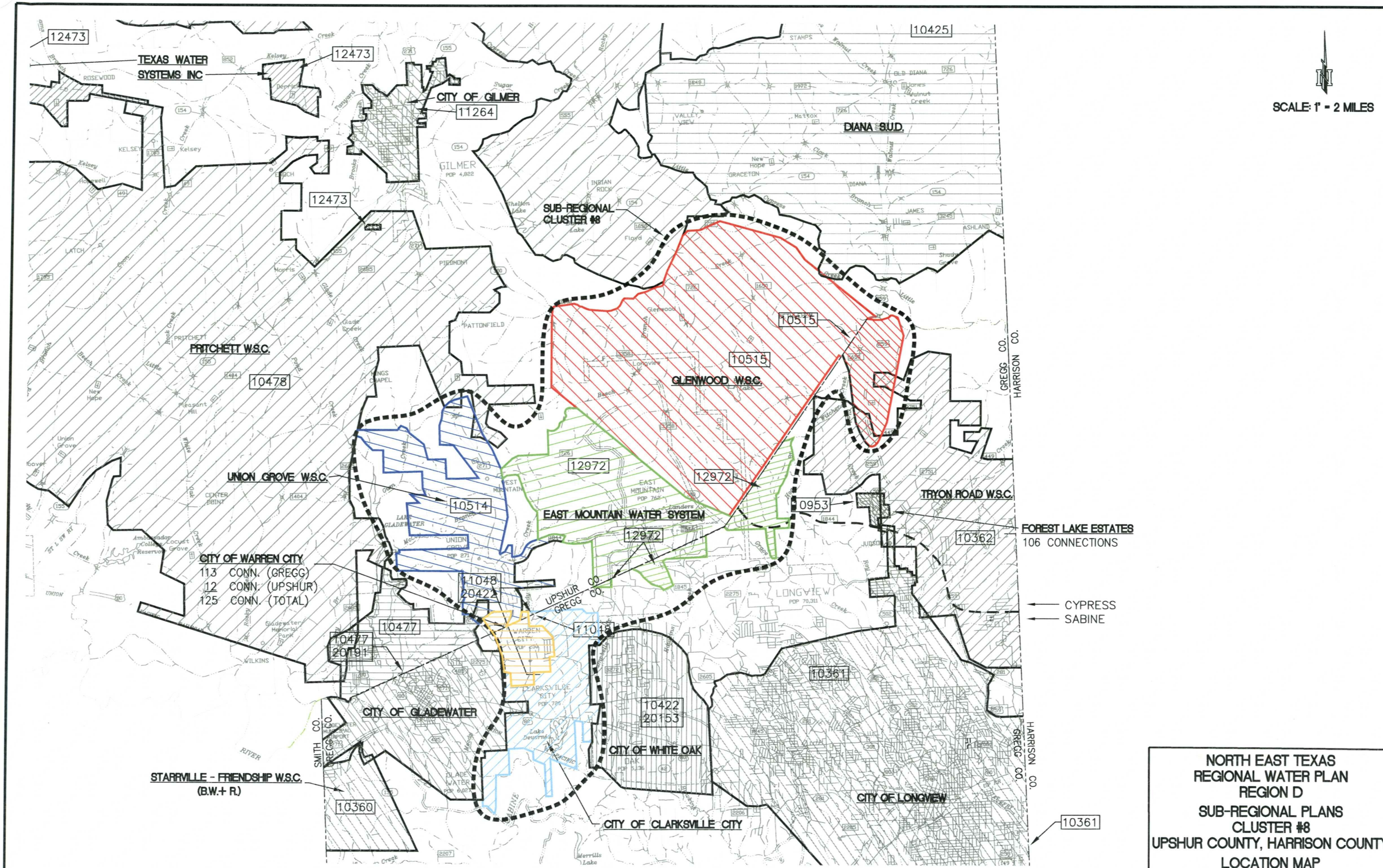
NORTH EAST TEXAS
REGIONAL WATER PLAN
REGION D
SUB-REGIONAL PLANS
CLUSTER #5
VAN ZANDT COUNTY
LOCATION MAP



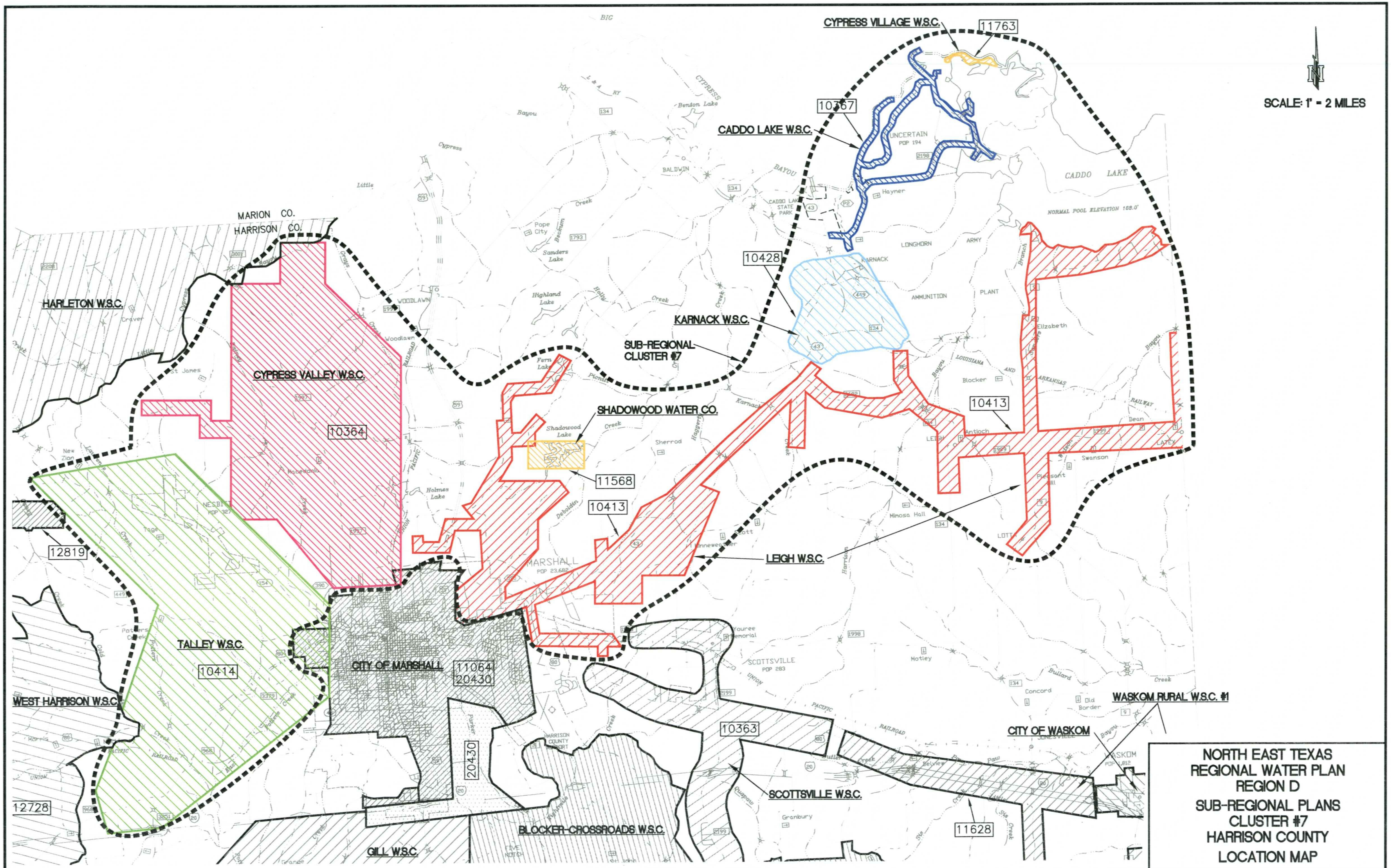
NORTH EAST TEXAS
REGIONAL WATER PLAN
REGION D
SUB-REGIONAL PLANS
CLUSTER #10
SMITH COUNTY
LOCATION MAP



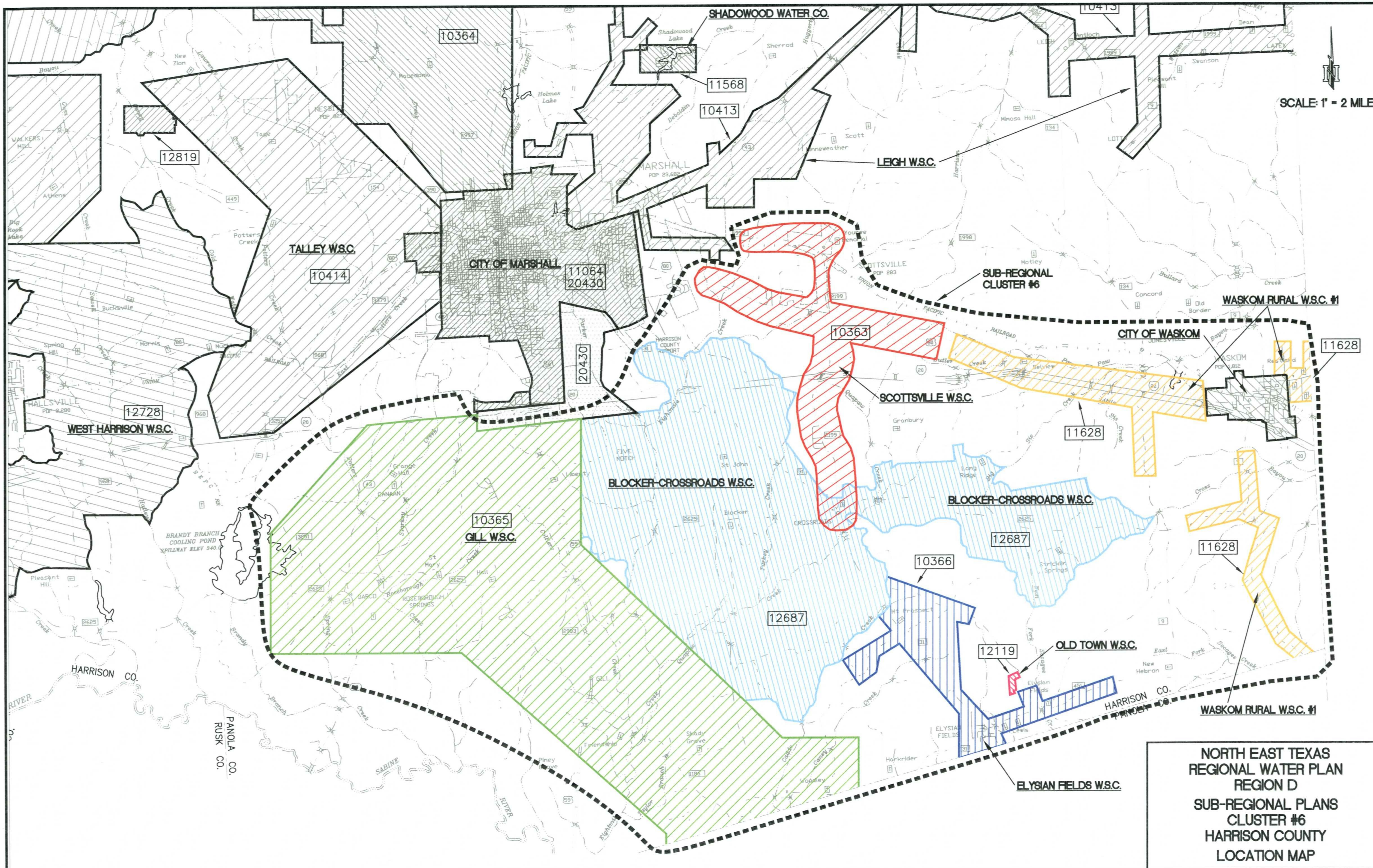
NORTH EAST TEXAS
REGIONAL WATER PLAN
REGION D
SUB-REGIONAL PLANS
CLUSTER #9
SMITH COUNTY, GREGG COUNTY
LOCATION MAP



NORTH EAST TEXAS
REGIONAL WATER PLAN
REGION D
SUB-REGIONAL PLANS
CLUSTER #8
UPSHUR COUNTY, HARRISON COUNTY
LOCATION MAP



NORTH EAST TEXAS
REGIONAL WATER PLAN
REGION D
SUB-REGIONAL PLANS
CLUSTER #7
HARRISON COUNTY
LOCATION MAP
SCALE: 1" = 2 MILES
CYPRESS VILLAGE W.S.C.
11763
CADDO LAKE W.S.C.
10367
KARNACK W.S.C.
10428
SUB-REGIONAL CLUSTER #7
SHADOWOOD WATER CO.
11568
LEIGH W.S.C.
10413
HARLETON W.S.C.
CYPRESS VALLEY W.S.C.
10384
MARION CO.
HARRISON CO.
TALLEY W.S.C.
10414
12819
WEST HARRISON W.S.C.
12728
CITY OF MARSHALL
11064
20430
SCOTTSVILLE W.S.C.
10363
BLOCKER-CROSSROADS W.S.C.
GILL W.S.C.
CITY OF WASKOM
WASKOM RURAL W.S.C. #1
11628
CADDO LAKE
NORMAL POOL ELEVATION 168.0'
LONGHORN ARMY AMMUNITION PLANT
MARSHALL
POP 23,682
UNCERTAIN
POP 194
SCOTTSVILLE
POP 263



NORTH EAST TEXAS REGIONAL WATER PLAN REGION D

SUB-REGIONAL PLANS CLUSTER #6 HARRISON COUNTY

LOCATION MAP

Financing Alternatives

Typically, capital costs for construction of water and wastewater utility systems are provided through a combination of long-term debt, local contributions, and, where eligible, government grants-in-aid of construction. Funds for annual operating and maintenance costs, and amortization of the long-term debt are generally provided from user fees, supplemented in some cases by tax revenues.

Long-term debt will be in the form of municipal bonds for governmental entities, and as corporate bonds or mortgage notes for non-governmental sponsors. The bonds or notes may be sold to local banks, on the public market, or to various state or federal agencies maintaining programs for this purpose. Local contributions may include unencumbered funds accumulate by the sponsor from other activities, assessments on land developments, customer contributions, membership or connection fees. Various state and federal agencies may provide grant funds to projects which qualify and support the agencies established programs.

For operation and maintenance of water systems, the utility establishes an annual expense budget and, generally based upon metered water sales, a monthly user charge which will produce sufficient revenues to meet expenses. In some cases, wholesale contract revenues, sales taxes, property taxes, or other system revenues may also supplement user fees. When debt is issued by the utility, and supported only by revenues of the system, the bond or loan covenants may require that income exceed expenses by a “debt coverage ratio,” typically 1.10 to 1.25 times. This coverage may be avoided where a pledge of tax revenue can supplement the user charges, or where the debt is fully supported by tax revenues in lieu of user fees. Where the debt is issued in the public market, the credit rating of the issuer and the presence or lack thereof of commercial insurance guaranteeing repayment can affect the interest rate at which the debt is sold.

Table 1 illustrates the common alternatives available for financing the initial capital costs.

TABLE 1 – Financing Options

Upper Sabine Creek Regional Wastewater Interceptor System - North Texas Municipal Water District

Financial Assistance	Level	Type	Use	Eligibility
Rural Development, USDA (formerly Farmers Home Administration)	Federal	Project Grants and Loans	Installation, repair, expansion of waste disposal facilities, including collection and treatment.	Municipalities, counties, and other political subdivisions of a State, such as districts and authorities; associations, cooperatives, and corporations operated on a non-profit basis. Facilities shall primarily serve rural residents. Median household income level determines extent of grant assistance available. Loans can be for up to 40 years.
Texas Water Development Board (Drinking Water State Revolving Fund)	State	Loan (secured by bonds, certificates, or mortgages)	Construction, repair, or expansion of publicly owned wastewater treatment works including collection and treatment.	Municipalities, counties, districts, WSC's, and authorities are eligible to apply for CWSRF loans. Applications are prioritized, and loans are generally for up to 20 years, with a rate that is about 1% less than the current market rate for similar securities. In some cases, based upon median household income and user fees, a further subsidy may be possible. In 2004, a typical 20-year loan rate under this program is 3.5%.
Texas Department of Housing and Community Affairs (Texas Community Development Program)	State	Project Grants	Acquisition, rehabilitation or construction of public works facilities and improvements, clearance, housing rehabilitation, code enforcement, relocation payments and assistance, administrative expenses, economic development.	Eligible applicants are units of general local government (including counties). To be eligible each activity must directly impact on the applicant's need and must either: (1) benefit low and moderate income persons, or (2) aid in the prevention or elimination of slums or blight; or (3) meet other community development needs having a particular urgency. Maximum single grant is $250,000. Competitive selection process. Neither Districts nor WSC's are directly eligible, but the county can apply on behalf of either.
Texas Water Development Board: Water Development Fund II	State	Loan (secured by bonds, certificates, or mortgages)	Planning, acquisition, construction, or expansion of water and sewer facilities, including collection and treatment.	Political subdivisions and water supply corporations. Interest rate is based upon a national municipal bond index and varies periodically. Average financing period is 20 years, and, in 2004 a typical rate is 5.0%.
Issuance of Bonds	Local	General Obligation and Revenue Bonds; Contract Revenue Bonds	For construction, expansion, rehabilitation of municipal-type utilities and facilities.	Municipalities, counties, water districts, River Authorities, WSC's and for profit corporations, subject to certain limitations on tax rates and total amount of indebtedness.
Local Sources	Local	Cash	For construction, expansion, operation, or rehabilitation of municipal-type utilities and facilities.	Varies by entity. Sources may include membership fees; cash on hand; developer contributions; sales, franchise, or other tax revenues.